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THE ORGANISATION OF TRADE AND INDUSTRY.

WE referred in our last issue to the proposals of the Federation of British Industries respecting the setting-up of suitable machinery for facilitating the reinstatement of Labour after the war. We have several times emphasised the importance of this particular problem, because we recognise that unless we make all the preparations possible within the wit of man to secure industrial peace within our own borders, many of our other schemes will come to naught. But important as is industrial harmony, it is obvious that we cannot permanently secure it unless we see to it that our industries themselves are placed upon a satisfactory basis. We cannot have contented employés unless we have prosperous industry. To secure the best interests of industry in face of the new situation due to the war, and to provide for adequate expansion, better organisation both at Home on the manufacturing and trading side, and abroad on the business promotion side, is essential. On both sections of this subject we have written much for many years past, but since the war we have dealt more particularly with various aspects of the whole subject of national industrial organisation as it presents itself to us in considering the requirements of the future. Whatever may have been the faults and failings arising from the conditions of the past, we have now to face a totally new set of conditions, and if while we try to secure harmony between employers and employed we can also attain to something like workable harmony in the troubled ranks of employers, we shall pave the way for a better state of things. But we must remove grounds for suspicion and friction, and be rid of all thoughts of a style of Prussian domination and interference in our methods of dealing with each other, or our efforts will not be successful, and any element in or connected with associations which gives rise to suspicion as to motives is harmful, and should not be permitted. We have repeatedly asserted our conviction that in these days strong and discreetly-managed trade associations are essential, and in this issue we publish a full contribution which serves to emphasise some of the points that must be considered by the electrical industry if it desires to maintain a world-wide reputation for quality, and to secure reasonable return on the capital invested. It is not suggested by us that the writer covers the whole ground, but we think that only good can ensue from a serious study of his arguments.

Organisation at home, however, will not secure the future success that we all desire unless we also look to organisation and methods for bringing into line with present-day requirements the machinery which assures a free and constant inflow of business from abroad. It might be imagined that this matter had been worn threadbare in our pages during the last 10 years, but the case is one that has to be restated again and again. It has been summarised anew for us in a series of recommendations that have

been issued by the Federation of British Industries, already named, in regard to "The Promotion of British Trade in Foreign Countries." We welcome this statement of 16 foolscap pages, because it is opportune to the present situation, and because we agree with the Council of the Association that it deals with a matter of "urgent and vital importance to the future prosperity of the country." Accompanying it we find a list of the membership of this powerful Federation. We confess that, from our study of its development, we had expected to find electrical and engineering organisations in greater number and strength. The wisdom of classing big associations of firms and private firms side by side as members may not be quite apparent —that is by the way—but the only electrical Associations that we find in the list of "association" members are the British Electrical Federation, Ltd., which we believe does not stand on all fours with the other associations, being a group of connected concerns, really one undertaking, and the "Electric Detonator Fuse Trade Associations." Neither the British Engineers' Association nor the B.E.A.M.A. appears. In the list of "firms and individuals" we find the names of a considerable number of the best known electrical manufacturing concerns, so possibly those two Associations have left it for their own members to decide for themselves whether or not they will link up in this Federation. The recommendations advanced by the Federation are those of its Council, on which there are only two electrical names of any weight, but the value of the conclusions is not lessened by reason of their being advanced by some 40 representatives of all kinds of industries, for the case that they set out to study was that of all British industry rather than that of any specialised section.

We have not space to spare this week to do justice to the recommendations. At the moment we must be content with briefly indicating their general purport. It is proposed that all Government activities in connection with the promotion of trade abroad should be concentrated in one Department—the Foreign Office. The Commercial duties of this department should direct all services abroad, collect and distribute suitable foreign industrial information, promptly and vigorously support British efforts to secure contracts, &c. A large increase in funds for foreign trade expansion will be needed, and the Council sets out a scheme for the establishment of a large commercial branch of the Foreign Office which will keep in close and intelligent touch in various ways with the industrial and commercial community. Commercial Counsellors are suggested for each Embassy or Legation, to be in sole charge of commercial work. A large scheme of rearrangement and increase of the Consular service; the sending of a large number of technical and commercial experts to investigate the industrial and commercial conditions and opportunities in particular countries and markets; and the ensuring that those who hold any office whatsoever in connection with the Commercial Organisation Service advocated shall be natural-born British subjects, are all parts of the Federation scheme.

Seeing that this programme is so largely in accord with the spirit and character of suggestions that we have made in these columns during the past ten or fifteen years, we profoundly hope that the Federation will be able to secure the sympathetic ear of the new National Government for its trade expansion propositions, and that suitable action will not be long deferred.

Lighting Restrictions in France.

Apart from the compulsory closing of shops throughout France at 6 p.m., except in the case of pharmacies and of shops dealing in food products, further measures have been adopted by the Government to secure a fresh reduction in the consumption of electrical energy. In the first place, a decree was issued at the end of November which practically vested in the State the control of the electricity supply works. The first clause prohibited, without the sanction of the Minister for War, the conclusion of a new contract for supply or an increase in an existing contract for supply, in connection with all distributing networks which serve either Government establishments or establishments, works, and undertakings working for national defence. The second clause provided that, in the case of a network being inadequate to assure the simultaneous supply of energy necessary for works engaged on national defence, the public services, and private consumption, the Minister should be empowered to impose upon the supply company or undertaking an order of priority among these classes of customers, either continuously or only for certain hours of the day. In the event of the Minister being induced to requisition one or several of the Sectors concerned, all consumers will have to pay a price on the basis of the cost price to the State and *pro rata* to the amount of energy consumed by them.

As we go to press we read in the *Times* that at Paris on Tuesday a Council of Ministers decided, in connection with its measures for meeting the scarcity of coal, to introduce a sweeping change in private and public lighting throughout France. It is stipulated now that all municipalities must effect a two-thirds reduction on the normal consumption of the winter of 1913-14. Previous measures restricting private consumption of gas and electricity are now cancelled and each individual will be allowed his normal consumption, provided it does not exceed daily a cubic metre (35¼ cubic feet) of gas and three hectowatt-hours (300 watt-hours) of electricity. Beyond this minimum the consumption is restricted according to a progressive table.

Linking-up.

The discussions which have taken place in the I.E.E. on Mr. Peck's timely paper have revealed the existence of two distinct schools of opinion, consisting respectively of those who doubt whether it can be done, and those who know it can—the latter being fortified in their opinion by the fact that it *is*. Let it be granted at once and freely that there are difficulties to be overcome in operating stations of different frequencies, voltages, and phase in parallel; it is equally indisputable that there are material advantages to be gained by linking-up, and we decline to accept the view that the existence of difficulties is a serious argument; rather, it should act as an incentive to accomplishment, and stimulate electrical engineers, who are always achieving the impossible, once more to demonstrate their capabilities. Let them take their cue from the national movement, which has abolished the "Wait and see" policy in high quarters and substituted for it the policy of "Push and go," with results which are already becoming manifest. These may be but popular catch-phrases—they are full of significance for all that, and there is a weighty moral to be drawn from them. Those who "wait" will surely be left behind by those who "go" ahead.

We have no sympathy with the idea that the managers of the smaller stations will suffer any detriment from either the adoption of parallel operation or the introduction of bulk supply. Which is the better, to be at the head of a one-horse undertaking barely keeping its head above water, perhaps even showing a margin on the wrong side, paying inadequate salaries, and unable to develop beyond its narrow limits, or to be in charge of a thriving concern which, thanks to a cheap supply of electrical energy, is enabled to offer an attractive tariff, double the number of consumers, and quadruple its output within a few years, whilst showing a substantial annual profit which admits of the payment of good salaries to the staff? Surely there is here no room for doubt, and those who endeavour to persuade the central-station men to stand aloof are doing them an ill service.

NATIONAL INDUSTRIAL ORGANISATION.

By O. N. LOOKER.

The war has served to direct our attention to the marked differences in the methods adopted by the leaders of public policy in Britain and Germany respectively.

On the one hand we have seen a chivalrous desire scrupulously to observe the requirements of humanity and of international law (even to our own detriment), while on the other we have learned to expect the callous adoption of *any* measures—no matter how reprehensible—which have appeared likely to give our enemies a chance of securing even a temporary advantage.

This difference of outlook appears to be fundamental, since its effects are as marked in our commercial as in our military rivalry, although *evidence* of Germany's unscrupulousness in her trade campaign is naturally less strikingly apparent than in the activities of her army and navy.

It will be admitted, for instance, that whereas all the world instantaneously recoiled in horror from the authors of the *Lusitania* and other crimes, it has taken years for us to begin to appreciate at its proper value the insidious nature of Germany's "peaceful penetration" (!) into our commercial markets.

Yet it should have been obvious that both these classes of outrage are but the natural result of a fixed policy having a common origin in Germany's sinister materialism, although the fact that we are constantly urged to introduce German methods into our business life proves that, even now, there is no widespread recognition of the dangers inseparable from such a course.

In common fairness to those who advocate our adoption of German business standards, it must be admitted that they frequently do so, not so much from any profound belief that German methods are the *best* methods, but rather from an acute recognition of the defects in our own trading habits, which they rightly assume would benefit from an infusion of more scientific control and organisation.

This awakening to our own shortcomings as a trading nation is of distinct national benefit, and it is reassuring to find that, in contrast to our former apathy, many able minds are to-day focused on problems connected with trade development and security.

One of the immediate results of this mental activity has been the formation of a variety of trade associations and federations of manufacturers, all of which base their proposals on a candid recognition of the axiom that a united industry can achieve much more as a body than could possibly result from the individual and unorganised efforts of its members.

In some quarters there is a tendency to direct attention to the possibly pernicious effects of combined action by manufacturers, but, however much or little foundation there may be for such fears, there is certainly insufficient appreciation of the benefits which accrue to the consumer as well as to the producer from the co-operation of manufacturers *for the maintenance of the quality of their goods.*

It must be remembered that from the commencement of competitive industrialism, *i.e.*, ever since there existed more than a single source for any one class of goods, all manufacturers have been controlled by the inevitable law which has forced them to seek the favour of the potential buyer by constantly reducing their selling prices.

The operation of this law in its early stages is always highly beneficial to the community, in so far as it compels the manufacturer to adopt all available means of cheapening the cost of production; but, after exhausting all legitimate methods—such as the reduction of profits to the minimum and the introduction of improved designs and processes—some hard-pressed manufacturers succumb to the temptation to achieve their object by employing inferior or insufficient materials in the manufacture of their goods, and at that stage the public suffers.

With uncurbed competition this parting of the ways occurs, and will continue to occur, in every industry. There comes a time when the manufacturer of any article has to recognise that he cannot further reduce the selling price of his goods except by reducing their quality.

He has to make up his mind whether he will maintain the quality and demand a comparatively high price, or reduce the price *and the quality* of his goods to those of his competitors.

The former course is only possible in very few trades, and the result is so difficult to foresee that an incorrect decision would generally mean ruin.

The difficulties inherent to the alternative course can only be overcome by all manufacturers in a particular trade recognising these inflexible laws and mutually undertaking that the *quality* of their manufactures shall not fall below an agreed standard.

Such arrangements generally lead to agreed prices, which have been so much feared in the past, but it is now recognised that such agreed prices, if honestly arrived at, are an advantage to the whole community.

Cut-throat competition, with its attendant deteriorating influence on quality, is the only alternative, and such a policy not only ruins the producer and disgusts the consumer, but also necessarily throttles progress. Uncontrolled manufacturers become demoralised and, in time, lose the art of making reliable goods. They, furthermore, have no funds for the prosecution of research, which is admittedly more prolific of early results if carried on in the manufacturers' laboratories than in any purely scholastic institution yet conceived.

Parenthetically, it may be noted that the question of research is now receiving attention at the hands of the Government. The President of the Privy Council, when recently announcing the formation of the Imperial Trust for the Encouragement of Scientific and Industrial Research, laid great stress on the necessity for the creation of large industrial associations, on the ground that it was futile to attempt to forward this important matter by negotiation with individual firms.

Bearing in mind our opening reference to the fundamental difference of outlook held by British and German people respectively, it is not surprising that British manufacturers have characteristically striven for *quality*, whereas their German competitors have striven for *cheapness*, which—considered apart from any assistance given them by tariffs, subsidies, financial co-operation, &c.—can only be achieved by lowering the quality of their goods.

Trade control has indeed become a *sine qua non* of successful British industry, and it may be said that no experienced capitalist would to-day enter into a competitive manufacturing business without some assurance that, by co-operation with his competitors, such trade would be controlled.

Consequently, we have to-day in England manufacturers' associations arising on all sides for the maintenance of the quality of every kind of goods, *e.g.*, boots, bedsteads, tubes, rivets, nails, machine tools, motor-cars, tires, saddlery, tanks, wire netting, ironmongery, jewellery, paints and varnishes, brushes, dynamos, incandescent electric lamps, electric cables, accumulators, cast-iron pipes, bird cages, chains, tinned sheets, steel rails, carriage lamps, garden rollers, glazed tiles, sporting guns, ordnance guns, plate-glass, oil, files, &c.

By way of illustrating the widespread recognition of the good work accomplished by such trade associations in maintaining quality and general control,

it may be mentioned that impartial bodies, such as the Engineering Standards Committee, turn to these associations (and not to individual firms) for information and guidance before setting up standard specifications for the various goods they describe.

Mr. Asquith, in the House of Commons on August 2nd, 1916, when dealing with the White Paper on the proceedings of the Paris Economic Conference, drew special attention to the extraordinary enterprise and resourcefulness shown by a large number of British industries since the war broke out, and laid particular emphasis on two tendencies, saying:—

> The first is the development of trade associations for common action at home and abroad, raising the average standard of production.
>
> The second is the recognition of the leeway which we have to make up as regards scientific research, and the utilisation of its results and its application to technical and industrial purposes.

Government departments now negotiate with associations on points which they will not even discuss with individual firms, and the recommendations of the Faringdon Committee regarding the establishment of a British Trade Bank provide further evidence that the Government's advisers appreciate the necessity for co-operation in matters pertaining to trade.

A perusal of the addresses delivered at the commencement of the Session 1916-17 to the members of the Institution of Civil Engineers and of the Institution of Mechanical Engineers by their respective Presidents shows that both of these eminent gentlemen lay special stress on the necessity for the encouragement of the "association" movement amongst all British manufacturers.

Again, the Institution of Electrical Engineers, when recently giving evidence before the Electrical Trades Committee appointed by the Board of Trade, stated that "*some combination* of British electrical firms, especially for foreign trade, *is desirable.*"

It may interest our readers to review the history of their branch of the engineering industry, more especially as its entire existence practically falls within the lifetime of the present generation, and its evolution provides a concrete example of the bitter experiences suffered by British manufacturers before our leading institutions arrived at their present appreciation of the advantages of co-operation.

At the close of the 19th century, the electrical industry, which, it is generally acknowledged, has never experienced prosperity adequate to the capital, enterprise, and ingenuity expended upon it, reached the lowest stage of its depression, in which it continued for many years.

It seemed as if the legislation of this country and the competition from abroad would prevent it from ever again holding up its head.

The public generally had no experience to guide them when purchasing electrical equipment, and, accordingly, *the price* was the chief and often the only consideration.

Any manufacturer desirous of improving the quality of his goods was further hampered by the circumstance that in many cases his superior, and consequently more expensive, goods differed *in appearance* very slightly from those of his less scrupulous competitor, whose object was to make immediate profits rather than an enduring reputation.

A striking demonstration of the disastrous effects of this policy occurred some years ago in the dynamo and electro-motor trade, when, it will be remembered, the competing manufacturers were tempted to starve their machines by cutting down the weights of iron and copper employed in their construction, thereby increasing the maintenance cost and risk of failure by breakdown.

The inevitable result was that the manufacturers were brought to the verge of ruin by their cut-throat competition, and the consumers slowly came to realise that the policy of accepting the lowest price was not free from serious drawbacks.

No arguments or experience can prevent such result. It occurs time after time, to-day in one trade and to-morrow in another. As long as consumers demand the cheapest, it is only human nature for manufacturers to reduce the quality in order to reduce the price.

Latterly, the general situation in the electrical industry has been improved, owing largely to the efforts of the British Electrical & Allied Manufacturers' Association (B.E.A.M.A.), whose members have learned that, while competition in *quality* benefits the maker and user alike, unrestrained competition in *price* must be disastrous to both.

In addition to its achievements in the above direction, this Association has done much towards establishing the electrical trade on an equitable basis by setting up standard "Conditions of Contract," which have been formally approved by the Institution of Electrical Engineers and accepted by all the principal municipalities and other large consumers throughout the country.

The B.E.A.M.A. has further provided, in many instances, for Parliamentary representation for the redress of different evils, and to-day it is most active in making preparations for trading after the war.

So broad are its views in such matters that it is not working solely in the interests of its particular members, but on behalf of all British traders.

Valuable pioneering by way of maintaining quality was years ago accomplished by the cable makers of Great Britain, who were, perhaps, the first of all English manufacturers to realise that the control of quality was absolutely essential to the welfare of the nation.

In fact, it may be said that the success of the B.E.A.M.A. is largely due to its appreciation of the value of the principles laid down by the Cable Makers' Association many years earlier.

The cable makers were particularly susceptible to the inevitable law referred to above (regarding cost-reducing expedients) in the manufacture of their goods, since the quality of a cable is so obscured that the difference between a cheap and a costly cable is only ascertained by the life test, *i.e.*, a good cable, of course, lasts longer than a poor cable, but there may be no appreciable difference in their appearance to guide the consumer when they are both new. Indeed, under some circumstances, it so happens that the inferior cable, when new, has a *better* appearance than the more costly article.

On the broad question of the relationship between quality and price, it may be said that once standards of quality are set up, the adoption of standards of price is an obvious and necessary sequel, and the public, accordingly, has for years been able to rely upon buying goods from any member of the Cable Makers' Association, at the same price, and of at least the same minimum and sufficient standard of quality.

To-day, thanks to such initiative, there are no cables to be found throughout the world to compare in quality with those manufactured in Great Britain, and the expression "Association Grade" is universally accepted as the hall-mark of quality.

By first organising each section of the engineering industry on the above lines, and then co-ordinating all these sections in one central association, it should be possible to bring the combined weight of the whole engineering industry to bear on any problem affecting its interests.

Similarly, other industries might form their sectional trade associations and thus pave the way for the creation of a Federation of United British Industries, on whose governing council representatives from all such organised British industries could meet and determine whatever joint action they

might deem advisable in the general interests of British trade.

It is admitted that the welfare of the British nation is dependent upon the prosperity of her principal industries, and all reasonable measures for fostering and safeguarding the interests of her producers are accordingly deserving of whole-hearted support.

Once our industries are thoroughly organised and alive to the urgent needs of the time, we need have no fear that "Trade After the War" problems will find us unprepared.

COAL MINING AND ELECTRICAL ACCIDENTS IN MINES FOR 1915.

The annual report of the Chief Inspector of Mines for 1915, which has just recently been issued, also includes the reports of the Divisional Inspectors, which hitherto formed separate reports, and which are very considerably reduced owing to the war, and hence we are unable to give any figures bearing upon the use of electricity in mines, or the amount of coal obtained by machine mining.

In view, however, of the vast importance of mining to the country to-day, and the very unsatisfactory attitude of the miners, it is interesting to note the results for the year 1915. In the first place, the total output of minerals is less by 14,588,210 tons, the amount for the different districts being :—

	Coal.	All minerals, including coal.	Total output of minerals for year 1914.
Scotland Division ...	35,596,856	39,690,127	43,686,414
Northern ,, ...	47,030,285	52,122,007	58,431,037
York. and North Midland Division ...	67,504,130	67,983,983	67,374,083
Lancashire and North Wales	24,923,976	25,110,278	26,445,277
Ireland	84,577	84,579	93,040
South Wales... ...	50,452,600	50,587,907	54,037,575
Midland and Southern	27,587,042	28,918,382	29,018,107
Total tons ...	253,179,446	264,479,263	279,085,473

The total output of coal for the year 1914 was 265,643,030 tons. (These figures do not include coal obtained in open quarries, which for 1915 was 26,635 tons), so that the reduction in the coal output is 12,463,584 tons.

Turning next to the number of persons employed, we find in 1914 there were 1,133,746 up to the end of July, but in December of that year this was reduced to 981,264, or 152,482 less. For the year 1915 there were 953,642 persons employed, or only 27,622 less than in December of 1914, or approximately 2¾ per cent. less, yet the output was 14,588,210 tons less, which is more than 5 per cent. reduction of output for a 2¾ per cent. reduction of *personnel*. There have been many serious complaints—and we regret there are yet—of slackness on the part of the miners, South Wales, the North of England and Scotland being the worst in this respect. An examination of the foregoing figures shows a reduction in output of approximately four million tons for Scotland, six million tons for the North of England, one million for Lancashire, and three and a-half million for South Wales, whilst Yorkshire and the North Midland Counties have actually increased their output, and the Midland and Southern have very nearly maintained the same output as for 1914. The pity of it is, there is no sign of any improvement in those four areas, although every effort has been made both by the Government and the labour leaders themselves.

In regard to accidents, we regret to note there was an increase of 78 in the total number of accidents in coal mines over the number in 1914, although a less number of persons were employed. We also regret that 12 persons met their death through the use of electricity. Of these, 8 occurred underground and 4 on the surface. There were 3 fatal accidents underground in the Scotland Division ; 2 underground and 1 on the surface in the Northern Division ; 2 underground and 2 on the surface in South Wales Division ; and 1 underground and 1 on the surface in the Midland and Southern Division.

As to the accidents themselves, the Inspector for the Scotland Division says :—"The three deaths due to electricity should *not* have occurred. In one case an apprentice, aged 15, probably from curiosity, opened the door of a switch panel, where the pressure of the current was 2,750 volts, and touching live metal, was electrocuted. In the second case, where a fall from the roof had occurred and covered a cable carrying current to a coal cutter, two men were set to work to clear the *débris*, although the current was not cut off. Such an ordinary precaution does not appear to have been thought necessary by the officials, if they thought about it at all, who set the men to work. One of the men received a shock by way of his shovel which either penetrated the cable or touched the conductor owing to the outer covering having been injured by the fall. The third case was due to the absence of a locking pin to cause efficient contact between the frame of a coal-cutting machine and the earth conductor in the trailing cable. As remarked, it will be seen that each of these three accidents could easily have been prevented."

Amongst the miscellaneous surface accidents, a manager was fatally injured when assisting to remove a drum of armoured cable. He was steadying the drum on its way from the store house to the power house down a slight incline, when he slipped and the drum ran over him.

In the Northern Division and the South Wales Division no particulars of the accidents are given. In the Midland and Southern Divisions the Inspector reports :—"Two fatal accidents from electricity were reported to me during the year, one underground and one above ground, each causing one death.

"The underground accident occurred to a haulage corporal, who received a shock from a current of about 350 volts through a 6-in. wire nail, which had been driven through the insulation of an unarmoured three-core cable, and had come in contact with one of the cores. There was no conclusive evidence to show whether he had been inserting or withdrawing the nail.

"The accident above ground occurred to a boiler smith's labourer, who was engaged on some repairs on a coke-quenching machine. He was removing an electric lamp, which had been temporarily put on to a circuit carrying a 500-volt alternating current by a fitter's labourer, unknown to the electrician or other responsible person."

In the Northern Division the Inspector reports a singular accident in connection with the use of electric safety lamps. "An unusual accident, fortunately not a serious one, although it involved the loss of considerable property, happened to a man in charge of the safety lamps at the Easington Colliery, Durham. This man was burnt about the arms while attempting to extinquish the flames from the burning celluloid cases of electric safety lamp accumulators. The origin of the fire is not definitely known, but it is suggested that in the process of charging, liquid may boil out of one cell and creep down the sides and across to the outside of an adjacent cell, thereby causing a short circuit and an arc. As may be imagined, with such a material as celluloid, unless immediate attention is at hand, a conflagration of considerable dimensions is soon inevitable. In this case, the batteries of some 1,200 lamps were rapidly involved ; in fact, the celluloid was consumed in about 10 minutes or less. The fittings in the lamp room were chiefly of wood ; the roof was also partly of wood, so that the whole interior, including the roof, was rapidly gutted. Work was resumed at the mine after a stoppage of one day only, as owing to so many men having left the neighbouring collieries, a sufficient number of oil safety lamps were available.

"If liquid cells are charged with strong acid, it may boil out during the recharging process. With proper attention and supervision, however, it is quite possible to charge these batteries properly without danger arising in the manner indicated above."

In the Yorkshire Division there were no fatal accidents, but a rather serious fire, with fatal results, broke out, which is reported as follows :—"On June 4th an underground fire occurred in a main haulage road, and caused death by asphyxiation of a deputy and a pony driver, whom it was found impossible to rescue after the fire broke out. The fire occurred in the main intake, about 1,000 yards

from the pit bottom. The roadway dipped in-bye, and was about 12 ft. wide and 7 ft. high; an electric cable for supplying current to seven motors of a total of 130 H.P. was suspended to the roof supports, which, for the most part, consisted of girders and covering wood supported by props. The covering wood took fire, and it was some hours before the fire could be subdued, notwithstanding that the supply of water was plentiful.

"Investigation showed that at about 3.30 in the morning a set of 20 full tubs ran away, through a stop catch being either put temporarily out of action by being spragged to allow empties to pass, or by dirt accumulating in the catch-box, and by damaging the electric cable referred to, caused the fire through arcing. The cable was a twin-core dielite insulated, armoured with single wire."

"The view of Mr. Charlton, H.M. Electrical (Temporary) Inspector of Mines, was that by the accident the cable was torn rather than cut in two; that at first there was not a dead short; that the two conductors were not fused, and an arc was probably established and maintained, taking a gradually increasing current after the metallic covering had been removed. He was also of opinion that had the protective device been actuated by leaking current, instead of the main feeding current, the fire would not have occurred."

"The cause of the fire could not, however, be laid to contraventions of the Electricity Regulations, and the owners, on being asked to install a leakage-current protection device, agreed to do so."

Time after time we have pointed out that most of the accidents in mines should not have occurred, and it is satisfactory to note that at least one Inspector quite concurs with these views. The cause is, undoubtedly, inefficient management—not always, however, on the part of the colliery manager—who, though legally responsible, has neither the time nor the necessary technical knowledge to thoroughly undertake this work, and too often has to make the best of such technical staff as his owners will allow him. What is wanted, as we have so often repeated, is a certificated engineer, with direct responsibility. Rules and regulations, fool-proof plant, and protective devices are of no use, unless there is a trained mind to understand the rules, and direct the use of the plant in a common-sense way, even if it is "guaranteed." Fool-proof things have a nasty habit of going wrong sometimes.

NOTES FROM CANADA.

[From our own Correspondent.]

Interesting figures showing how this country is faring during the war in regard to her trade, appear in a recent issue of the "Weekly Bulletin" of the Department of Trade and Commerce.

The total value of imports and exports of merchandise, in millions of pounds sterling, are approximately as follows for the years given, for the 12 months ending—

	Aug., 1913.	Aug., 1914.	Aug., 1915.	Aug., 1916.	
Imports ...	137	110	83	131	£ × 10^6
Exports ...	79	94	101	203	"
Total	216	204	184	334	

Canada's exports to Australia have almost doubled in value since 1913, and to the United Kingdom they have increased about 350 per cent., those to France have risen to almost 15 times the value, while those to the United States are of about 1½ times the value of the same period,

To British manufacturers the value of the imports classed under the heading of "electric apparatus" will be of interest, especially the comparison of figures relating to the United Kingdom and the United States.

During 1915-16 for the twelve months ending August, the total value of imports under the heading just referred to was about £1,070,000. The United Kingdom supplied goods worth about £42,000, and the United States £1,023,000 worth. The ratio between the values supplied by the two countries named is usually about 1 to 7, at present it is about 1 to 24. The home firms will need to be very active after the war is over even to restore the *status quo*.

It seems pertinent to remark here that it is possible that the Hydro-Electric Power Commission of Ontario may consider the question of providing itself with the means for properly approving of all classes of electrical supplies, materials, &c., in much the same manner as is now done by the Underwriters' Laboratories of Chicago. If this be so, British manufacturers should be able to secure more ready approval of their products than is possible with the Underwriters' Laboratories, since this is British territory. At the same time they will have to recognise that, to some extent at least, they will have to cater properly for the market, and that they cannot expect readily to sell goods of a new and unusual style, or even to have them instantly approved of, however good they may be.

Until war broke out (and even at the present time) people here are assumed to have a preference for articles with a high finish and plenty of ornamentation, at least one would judge so from the fact that it is seldom possible to buy perfectly plain, though good, fittings, &c.

Many articles, not merely electrical but of all kinds, plainly made, yet of good quality and often really much more handsome in appearance than the nickelled, coppered, or gilded and be-flowered ones, are obtainable in Europe at reasonable prices, whereas for a far cheaper looking article one pays much more here without being able to obtain the less elaborate and really better ones at all.

Possibly when the war is over, things may be somewhat changed, and the plainer goods at lower prices will be obtainable, as, if the cost of living keeps up and the present great wave of trade prosperity dies down, the public will be compelled to buy the cheaper goods with fewer frills about them.

An illustration may here be given as to what is meant by the foregoing.

The writer some time ago wished to secure an inverted glass shade for lighting a small room in a plain house, and looked around to see what shades were available.

The cheapest to be found were sold at 16s. or 20s. and were made of thick glass with elaborate patterns on and heavy brass chains; finally he bought an ordinary 14-in. conical opal shade of glass about $\frac{3}{32}$ in. thick, made some neat small brass clips and suspended it upside down with neat brass chain. The whole thing cost about 2s. and (except that it had a hole at the apex of the cone) was perfectly satisfactory and amply good enough for tens of thousands of homes of people who, though they may possibly buy the far more expensive articles found in the shops, yet are not really in a position to afford them,

One of the local (large) manufacturers of electrical glassware was approached on the subject as to the possibility of supplying a really cheap article such as has been described, and the reply given was that it would be quite impossible to sell such a "cheap-looking" article which had no fancy work on it at all. Other instances of this kind could easily be given.

It is open to doubt, however, whether undecorated and lighter articles at *much* lower prices than those usually asked, could not find a fairly ready market, were they on sale.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Large Gear Wheel.

We illustrate in fig. 1 a large split-gear wheel in process of being cut at the works of the Westinghouse Brake Co., 82, York Road,

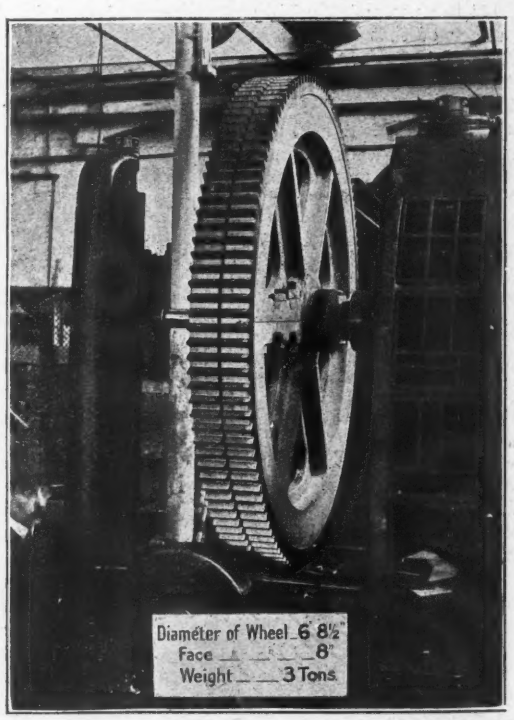


Fig. 1.—Gear Wheel for Chain-drive.

King's Cross, N. This is destined for the St. John del Rey Mines, Brazil, and forms part of a 80-H.P. Westinghouse-Morse rocker-joint chain-drive from motor to air-compressor. The wheel has 126 teeth, is 80½ in. in diameter by 8 in. face, and weighs 3 tons.

Electric Cooking at Dursley.

Through the courtesy of Messrs. R. A. Lister & Co., Ltd., of Dursley, we are able to illustrate an electric cooking installation at their works, which supplies 100 mid-day meals and a similar number at midnight, as well as teas and light refreshments. The cooking equipment is supplied from a 10-kw., 110-volt Lister-Bruston automatic plant, which, of course, responds automatically to any demand for energy. When this canteen was opened, tests were conducted by cooking in both gas and electric ovens. Two legs of mutton were cooked simultaneously, one weighing 8 lb. 1 oz. being put into the gas oven, and the other, weighing 8 lb., being electrically cooked. The joints were subsequently weighed, that cooked by gas showing a loss of 1 lb. 15 oz., as against a loss of only 9½ oz. in the electrically-cooked joint. The value of the saving in meat alone in the latter case more than paid for the fuel used in running the plant, although all the vegetables were also cooked electrically.

As the Lister-Bruston automatic plant can be connected to any existing private installation without adding to the number of cells in use or altering the lighting arrangements, even when a higher voltage is required for cooking purposes, Messrs. Lister maintain that it represents the solution of the country-house cooking problem, which has been hindered in the past owing to the large batteries necessary.

Fig. 2.—Electric Cooking Plant at Messrs. R. A. Lister's Works.

Fig. 3.—Lister-Bruston Plant supplying Electric Cooking Installation.

The Wedge Optical Pyrometer.

The Optical Pyrometer Syndicate, of 182, Temple Chambers, E.C., have brought out a simple and convenient type of pyrometer depending upon the colour of the heated object, when above 500° C. The instrument is calibrated for any range of temperatures desired between this limit and 2,100° C., and the scale usually extends over a range of 400° C., being divided into intervals of 20°. It can, however, be made for a range of 800° C., in steps of 50° C. It consists of a brass tube fitted with a small telescope, which focuses the image of the heated body on a movable prism inside the tube. A shield prevents extraneous light from reaching the eye. At one side of the tube is a milled head, actuating a rack and pinion, which moves the prism through the field of vision. The prism is made of a special dark glass, which cuts off the light emitted by a heated body at a point depending upon its thickness and the temperature; it is therefore moved so as to intercept more and more of the light until the image entirely disappears, a point which can be determined closely after practice. The error may, with experience, be brought as low as 10° C., which, at 1,400°, is sufficiently accurate in practice. The distance of the heated body makes no difference to the reading. As a workshop instrument it should prove very useful. It was invented by Messrs. Cochrane and Co., a well-known firm of ironfounders at Middlesbrough, for use in their own works, and their expectations were fully realised; each instrument sent out is calibrated by the inventor himself.

Reyrolle's Switch-type Fuse Boxes.

Fig. 4 shows an ironclad fuse-box of the switch type manufactured by Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne. These fuses are of simple and robust construction, special attention being given to cable inlets, and no sharp bends being required. They can be supplied for 50 or 100 amperes, suitable for 500 volts and 1,000 volts. The cases have fireproof linings, and the fuse wire is contained in a fireproof tube, thus enabling short circuits to be satisfactorily dealt with, whilst the fuses can be renewed with ease and safety.

The simplicity of the construction renders them particularly suitable for wiring installations necessitating quick handling. This make of switch fuse is also suitable for use as a simple and effective L.T. isolating switch.

Fig. 4.—Switch-type Fuse Box.

Fig. 5.—The Wedge Optical Pyrometer.

Electrician Sentenced.—For having matches in his possession whilst in works where explosives were being manufactured, John Freeman, a Huddersfield electrician, was sentenced to one month's imprisonment in the second division. Defendant pleaded guilty. He was in a drunken condition when the offence was committed.

Board of Trade Changes.—It is understood that the Board of Trade is being completely reorganised. The Labour Department should eventually pass under the control of the Minister of Labour, who will at once take over important functions from the Ministry of Munitions. Offices have been set aside for the Minister of Labour at the Ministry of Munitions in Whitehall Gardens.—*Times.*

D

LEGAL.

Rating of Electric Tramway Lines.

L.C.C. Appeal.

At the County of London Quarter Sessions, on December 12th, Mr. A. P. Lawrie, K.C., Deputy-Chairman, and another magistrate, concluded the hearing of the appeal by the London County Council against the assessment of their tramway lines in the boroughs of Holborn and Finsbury.

The case for the Assessment Committee of the Holborn Union terminated with the evidence of Mr. A. L. Ryde, surveyor, of Parliament Street, S.W., who arrived at a rateable value of £24,515, compared with the assessment of £13,818 appealed against and £6,960 claimed by the County Council. In witness's opinion, the earnings of the tramways in Holborn and Finsbury were greater than on the routes outside, and he had added 1½d. per car-mile to the average receipts of each route. There were halfpenny fares in the Holborn Union, but not in the country districts, and while the maximum penny fare on the system was nearly two miles, the maximum halfpenny fare was 930 yards. In cross-examination, Mr. Ryde admitted that there was a substantial difference in the amount he had allowed for repairs and renewals of cars and lines, and the amount which had been allowed by witnesses for the County Council. It might be true that 10 per cent. of the cars had been added within a period of five years, but he thought he had allowed sufficient to enable the Council to go on renewing piecemeal.

Mr. Clavell Salter, K.C., M.P., addressing the Court in support of the assessment, submitted that there was no comparison between the central district in question and boroughs like Woolwich, Camberwell and Lewisham, where the rateable value had been agreed. The Holborn Union was like "the fat middle" of provincial towns, though in the latter the tramways ran right through, whereas in London they had to come to a stop. The County Council officials informed them that the average number of passengers per car-mile over the whole system was 9·32, and that the average takings were 9·5d. per car-mile, showing a fraction over a penny per person. People who used tramways and 'buses did not ride anything like the full distance; on an average they rode about three-quarters of the distance they could go. He submitted that the receipts in the Holborn Union were far above those outside. Figures given by a witness for the Council showed that on four services at Holborn Town Hall there was an average of 15 persons, and evidence for the Assessment Committee showed that at the Moorgate Street termini the numbers were about double the average of the system.

The Deputy-Chairman: Assuming there is a larger traffic on the cars in the Holborn district, has that not got the necessary result of increasing the expenses of every kind in that district? There are more stopping-places, both compulsory and voluntary, when behind carts and when stopping at ordinary stopping-places. There is much slower running than one gets in less crowded districts, and, consequently, there is more wear and tear. The brakes, I understand, are some of the most damaged parts. In addition to that there are more tickets issued and more punches worn out. The six dead-ends (the termini) also take my eye a good deal, although the figures Mr. Clavell Salter has quoted show that sometimes they are not as dead as they might be. Then there is the extra labour which is necessary at the dead-ends for the purpose of switching on to lines. Taking all those things into consideration, and there may be a great many more, it would seem to me that in all probability that would balance, and perhaps more than balance, the extra receipts taken from extra passengers.

Mr. Clavell Salter admitted at once that cars running full and doing a brisk business involved more expense than cars running comparatively empty. But he should have thought that the additional expense would be very small compared to the additional profit, and that it would, in fact, be almost negligible. The case was one of considerable importance, as provincial centres would doubtless point to the decision of that Court.

Mr. Walter Ryde, K.C., on behalf of the County Council, submitted that the Court could never consent to a departure from the system which had been adopted in the case of seven south-eastern metropolitan boroughs in the rating of the County Council tramways. The rateable value of the whole system must be taken together, and the various parts when taken together must not exceed the value of the whole. If the Court was satisfied—though it was not definitely proved—that Finsbury and Holborn were above the average, the Court might yet regard the figures as so much guesswork, and not feel justified in putting a higher value on the tram-lines in question.

The Deputy-Chairman: You may leave that branch of the subject, because we are agreed upon it. I am satisfied, in my own opinion, that, assuming there is a larger number of people travelling on the lines in the Holborn Union, that is amply set off by the additional expenditure necessitated. On the facts put before us, we are quite clear as to that.

Mr. Ryde, proceeding, urged that it was impossible to ignore the existence of the war in making a rating valuation. The war had affected this property enormously, because every contract had to be made under war conditions. Conditions had altered very materially for the worse.

The Deputy-Chairman: At the same time, if you invest money to-day you surely expect, when the time comes to realise it, that it will be appreciative, and not depreciative, unless the war is going on for ever.

His Lordship announced that the Court would give judgment on the appeal on December 21st.

British Thomson-Houston Co., Ltd., v. Duram, Ltd.

Tungsten Wire Patent Litigation.

(*Concluded from page 656.*)

On December 12th, Mr. Ballantyne was cross-examined by Mr Walter, K.C., for the plaintiffs. Replying to questions, Witness said he did not believe that drawn wire was easier to make than sintered filaments. He thought it was largely used because the metal suitable for squirted filaments was no longer obtainable, as it was made in Germany. He had had experience of the lasting power of lamps. Comparing drawn-wire lamps with squirted lamps, he found that the drawn-wire filament became brittle in a few hours as compared with the other.

Dr. J. E. Stead, metallurgical and consulting chemist and vice-president of the Iron and Steel Institute, was also examined, by Mr. Kerby, who asked: What does the patent that we are trying here tell you beyond what you find in Moissan?—Nothing at all.

On Wednesday, Mr. Kerby, summing up the defendants' case on the question of validity or invalidity, said the defence was three-fold:—(1) the patent was bad, because the claim was too wide; (2) because it had been completely anticipated; and (3) in view of the existing knowledge of the time, there was no subject-matter. The existing knowledge, counsel said, which he relied on, apart from general metal-working knowledge, was the known parallel of osmium, which had been shown to be pliable, and the Siemens patents of 1902 and 1904, which assumed as common knowledge, as indicated to any instructed person, everything that was indicated in the plaintiffs' specification. He also relied on insufficiency. As to his point that the claim was too wide, counsel contended that it was purely a claim for working tungsten hot. He could put it that it was for working tungsten coherent hot, but that made no difference, because there was really nothing whatever in the suggested limitation of coherency. It included the ordinary workshop methods. In ordinary language, it told one that one had to make the tungsten hot. Therefore, by implication it told one that the tungsten must be got into a form in which it could be worked hot. The claim was too wide, as he had said, because it included the working of tungsten hot, and therefore it was a claim to a bare principle; and a claim to a bare principle was generally bad. Then the claim was merely routine; heating a metal for the purpose of operating on it was an ordinary everyday proceeding in a workshop, and had been the ordinary method of dealing with metals since metals were first dealt with.

The case was proceeded with on December 13th and 15th, and the defendants were permitted to call certain witnesses before the plaintiffs' witnesses, as they were engaged on urgent Government work.

Mr. John Robert Parry, foreman in the employment of Messrs. James Brown & Co., Preston, wire drawers, described certain experiments in wire drawing in 1905-1907. He drew steel wire through a steel die, having dipped the wire in graphite.

Mr. John Gustav Adolph Rhodin, chief chemist of the Muntz Metal Co. from 1903 to 1905, gave evidence as to drawing zinc wire at a temperature of 150° C. to 120°.

Mr. John Wade, of Messrs. E. and A. Smith, wire drawers, Cleckheaton, was also examined.

Dr. Passmore, chemist and metallurgist, gave evidence in support of the plaintiffs' specification.

Mr. Justice Astbury expected to finish the hearing on Monday, December 18th, but his Lordship was unable to come to Court that day, as he was suffering from influenza.

His Lordship, on Tuesday, gave judgment. With regard to the first patent of 1906, relating to an apparatus for the treatment of metallic tungsten and for the manufacture of electric lamp filaments therefrom, his Lordship said an admission had been made which rendered it unnecessary to consider the question, except on a very narrow consideration, and the real question was the validity of the patent—want of novelty, want of subject matter, and insufficiency being alleged against it. The substantial invention, if there was one, made by the patentee was the production of a wire-drawn electric lamp filament of tungsten, but he had not been content to so limit the claim. The claim was a wide one for the working of pure coherent tungsten hot, and was not limited to any specific degree of working to any defined end provided the working was commercial working for commercial purposes. The description coherent tungsten included other forms in addition to that produced by the patentees' process. The patent was therefore bad for want of subject-matter, and was invalid. As to the second patent of 1911 for improved methods of wire drawing, his Lordship said, on the objection of prior user, he had come to the conclusion that it was impossible to escape the consequences of the user of Messrs. Brown & Co., Preston, which was proved to have taken place in 1905 and 1906. This patent was also invalid, and the action must be dismissed.

Dunlop Rubber Tyre Co. v. Humphries.

In the Dublin High Court, before Mr. Justice Barton, Mr. J. Humphries, electrical engineer, &c., Enniskillen, agreed to an injunction being given against him, at the suit of the Dunlop Rubber Tyre Co., and undertook that no irregularity would occur in his sale of the company's tires. It had been alleged that he sold for 10s. a tire, the standard value of which was 11s., and the company held that the case involved thousands of pounds to them. Plaintiffs did not ask for costs.

Mr. Justice Barton said the agreement was not in restraint of trade, and it was only right to warn traders of their obligations in regard to such contracts.

WAR ITEMS.

Controlled Works.—The number of establishments now controlled by the Ministry of Munitions is 4,585.

Allied Conference.—The General Technical Conference of the Allies, the formation of which was decided upon at the Allies' Economic Conference last June, met for the first time last week in Paris. The object of the Conference is to prepare for unity of legislation in the Allied countries regarding patents, trade marks, and kindred trade subjects.

Training Disabled Soldiers.—The governors of the Royal Technical College, Glasgow, at the request of certain donors, offer prizes, amounting to £70, for essays on the best methods of training and employing in industries, other than agriculture, returned soldiers and sailors, maimed or otherwise. Essays must be sent in by March 1st, 1917, addressed to The Director, the Royal Technical College, Glasgow.

The Use of Railway Wagons.—An Order in Council has been issued stating that the Board of Trade may, for the purpose of making the most efficient use of railway plant or labour, with a view to the successful prosecution of the war, make orders for all or any of the following purposes, namely:

(*a*) For enabling the Board of Trade to take possession of any private owner's wagons and to use those wagons in such manner as they think best in the interests of the country as a whole, on such conditions as to payment, use, and otherwise as may be provided by the order.

(*b*) For enforcing the prompt loading or unloading of wagons, by making failure to load or unload in accordance with the order an offence.

(*c*) For curtailing any statutory requirements as to the running of trains or affording other facilities on certain lines or at certain stations, or for requiring the disuse of any such line or station, in cases where the curtailment or disuse appears to the Board of Trade to be justified by the necessity of the case.

(*d*) For restricting or prohibiting certain classes of traffic (including the carriage of passengers' luggage) on railways either absolutely or subject to any conditions for which provision is made by the order.

(*e*) For modifying any statutory requirements with respect to the maximum amount of passenger fares.

Any order may be made so as to apply generally to all railways or to any class of railways or to any special railway.

To be Wound Up.—The Board of Trade has ordered the following business to be wound up:—

Decauville & Co., 31 and 32, Broad Street Avenue, London, E.C., late 10, Eastcheap, E.C., makers of portable railways. Controller: G. S. Pitt, 140, Leadenhall Street, E.C.

Exemption Applications.—At Westminster Tribunal, the Tudor Accumulator Co. applied for the exemption of 23 men, one single and 21 years of age passed for C1, and the others married, their ages ranging from 32 to 40. The Military Representative said the Advisory Committee had been unable to come to an agreement with the firm. Although they were in certified occupations they ought to be able to let some of the employés go, for Class A men were badly wanted. There were altogether 16 A men in the list. A representative of the firm said the men were indispensable to the maintenance of important London and provincial tramway and electric lighting undertakings. The lighting of London's principal buildings, including the Houses of Parliament, depended upon the company and its staff. They were all in certified occupations. The Military Representative said that some of them ought to be given up now, but there would be great changes on January 1st in the lists of certified occupations, and they might be out of them next time. Exemption for a period of four months was granted.

At the Hull Tribunal, a tramcar driver claimed exemption. It was stated on his behalf that tram drivers over 25 years of age and married were in a certified occupation. The instructions were that the list of certified occupations should be strictly observed by Tribunals and the Military Representatives, the Government Department having prepared the list in consultation with the Army Council. The fact that the Corporation had decided not to appeal for tram drivers did not affect the position so long as the men were over 25 and married. The Tribunal said it was the first time the point had been raised, and granted the man exemption.

At Bromley (Kent), an appeal was made by Mr. A. C. Edwards, electrician. He said that as he had received no notice to go before the Medical Board he had not been medically examined as ordered. The Tribunal decided to treat him as one passed for general service, and refused exemption.

On the appeal of the Military, exemption allowed to Mr. S. J. Nettleingham (24), electrician to the Thames Portland Cement Works Co., Higham (Kent), has been withdrawn, and substitution ordered.

Crediton Rural Tribunal has granted six months' exemption, with the assent of the Military, to W. Drew (40), electrician to Mr. A. Tremayne Buller, of Downs, having charge of eight motors for agricultural purposes.

Reigate Rural Tribunal has granted temporary exemption to January 15th to W. Adams (29), electrician, of Galton, with no further appeal without leave.

The West Kent Appeal Court has refused a claim for exemption filed by Mr. F. G. Jones (39), electrical engineer, of Gravesend, passed in Class B1.

Before the East Kent Appeal Court, Mr. H. T. A. Curtis (33), electrical engineer, of Ramsgate, appealed, and stated that he was responsible for the running of a public lift, and the maintenance of machinery at military and naval hospitals. The appeal was rejected.

At Bath, Messrs. J. Lambert & Sons sought exemption for G. Clark (34), electrical wireman, passed for C1. Clark had been before the Rural Tribunal, and had received two periods of exemption. The Tribunal decided that they had no jurisdiction in the case, and referred it to the Rural Tribunal.

Mr. J. Hutt, electrical engineer, applied to the Coventry Tribunal for renewed exemption, and stated that he was engaged entirely on work for local factories, and had had to refuse private work. In his spare time he had done Special Police work. It was mentioned that there was a great scarcity of electricians in the city. Two months were allowed.

At Aldershot, the Traction Co. appealed for eight employés, with the following results:—Mr. Webster (secretary), two months; night foreman-fitter, three months; three fitters, three months each; works foreman-engineer, six months; tinsmith, six months; and a driver, three months.

At Worthing, the borough electrical engineer appealed for a meter reader, and said that he doubted the ability of a woman to do the work accurately. Three months were allowed, subject to substitution. Three months each were also conceded to a cable jointer and his mate, an engine driver at the generating station, a machine fitter, the assistant electrical engineer, and a switchboard attendant (final). The permanent staff has been reduced from 22 to 10.

Exemption granted to Mr. T. H. Escott (28), manager for Messrs. Brooking & Co., electricians, Weymouth, was appealed against by the Military Representative. The borough electrical engineer and a number of business men of the town wrote as to Mr. Escott's skilled work and indispensability. The Tribunal cancelled conditional exemption, and gave until March 31st, with no further appeal without leave. The Chairman intimated that they expected the firm in the interval to train a substitute.

At Lindfield (Sussex), an electrical engineer in business at Hurst, aged 41, and passed in Class C2, and who has lost his manager, leaving him with only a man with a short exemption and a lad, had his period of exemption extended for six months.

At Broadstairs, the Military Representative applied for a review of exemption granted to the chief clerk (41) and a motor and tram driver (40), with the Isle of Thanet Tramways Co., on the ground that they were no longer in certified occupations. The company's representative stated that the former was the only clerk left, and that the driver could not possibly be spared owing to the great depletion of the staff, which compelled him to work seven days per week. The exemptions were confirmed, and will continue whilst the conditions remain the same.

On the appeal of Sir Wm. Vernon, the Chester Rural Tribunal has given six months' further exemption to his electrician, passed in Class C2, and who is engaged on hospital work.

At Lewisham, the Military asked for a review of exemption granted to F. G. Howard (24), a draughtsman with Messrs. Johnson & Phillips, Ltd., of Charlton. Respondent, who had stated that he had a conscientious objection, handed in a badge and a certificate showing that he was engaged on war work, and the Military Representative said that he should try to get the badge withdrawn. The application was not proceeded with.

The Military applied at Lewisham for conditional exemption held by an electrical engineer, aged 32, and passed for general service, to be withdrawn. It was stated that certain of respondent's employés had been badged. The Tribunal substituted six months' exemption.

Chatham Tribunal have granted six months' exemption to A. H. Laraman (19), electrician, appealed for by the Kent Electric Power Co., and passed for C3.

Hereford City Tribunal have granted exemption to March 1st to J. Hoskins, fireman at the municipal refuse destructor.

At Sutton-in-Ashfield, exemption on business grounds was claimed by Mr. A. E. Hough (36), managing director and electrical engineer for Messrs. Cinevars, Ltd., a theatre concern. Three months were conceded.

Worcester Tribunal has granted a certificate of conditional exemption to G. Harris (40), public lamp attendant and emergency man, applied for by the Corporation Electricity Committee.

Warwickshire Appeal Court has refused further extension of time to a charge-hand at the refuse destructor of the Rugby U.D.C. It transpired that the man's wages were 30s. per week, and the Chairman said it was a disgraceful wage; charge-hands at the Coventry destructor were earning £3 10s. per week.

Torquay Tribunal has granted exemption to January 15th (final) to Mr. P. T. Narracott (36), electrician, passed in Class C1; but has refused time to F. J. Hammett (24), electrician at the Picturedrome.

Mr. D. R. A. Millman, electrician, passed in Class C1, appealed at Newton Abbot, and a month was granted for him to obtain a post of national importance.

At Bath, appeals by the Electric Tramways, Ltd., resulted as follows:—Body builder (41), three months; coach painter (37), three months; blacksmith (39), appeal withdrawn without prejudice; engine driver (38), conditional exemption; car driver (39), three months. It was stated that 202 employés had enlisted; the pre-war staff was 282 men, nine boys, and 21 women; and now there were 136 men, 23 boys, and 75 women.

At Windermere, an appeal was made by Mr. J. K. Thornborough (34), electrical engineer, partner in the firm of Thornborough Bros. He is passed in Class B1, and his younger brother is serving. Three months' temporary exemption was conceded.

At the Aberdeen City Military Tribunal, the Military Representative appealed against conditional exemption granted to A. B. Gillespie, electrical engineer. It was pointed out that there was a serious dearth of electrical engineers in the city. The case was continued so as to give the man an opportunity of engaging in work of national importance.

ELECTRICITY SUPPLY.*

Mr. J. A. Robertson, borough electrical engineer of Salford, gave the opening lecture of the session to the Technical Section of the Westinghouse Club. In the course of his address Mr. Robertson gave a short summary of the early supply of electricity in this country, and referred in detail to the question of centralisation and interconnection of electricity supply. He said:—

We have learned many lessons from the war, but the greatest of all is that we cannot allow ourselves to drift along in the same haphazard way that we have been accustomed to in the past. It has become evident that if we are to maintain our position as a manufacturing and commercial nation during the trying years immediately subsequent to the war, we must begin at once to organise our national resources in material, labour, and brain power so as to produce the highest possible degree of national efficiency.

It must always be remembered that primarily we are a manufacturing nation. Our position in the world has been earned not so much by military or naval conquest, as by the fact that we were the first to sell the product of our skill and industry in the markets of the world. Cheap supply of power is one of the first essentials of the manufacturer, and if by centralising its production we can substantially reduce the cost, it will not only reduce the cost of manufacture, but at the same time conserve the national supply of fuel. To achieve this object, no existing interest, be it municipal or company, should be allowed to stand in the way.

Chiefly as a result of the steam turbine, a modern power station can be erected and equipped to-day at a cost per KW. less than one-fourth of what obtained 15 to 20 years ago. At the same time, the operating costs have been reduced by 50 to 60 per cent., or if allowance be made for the increased price of fuel, it may be said that the operating costs are about one-fourth of what was achievable in the old reciprocating plant stations.

Corresponding with the change brought about by the steam turbine in the power stations, the adoption of high-tension multiphase transmission has completely altered the conditions of distribution. Whereas with low-tension current an economical area of supply was seven or eight square miles, the area which can now be supplied from one station may be reckoned in hundreds of square miles.

It has been suggested that a national board should be set up with powers to erect new super-stations on modern lines, to sell energy in bulk to existing supply authorities.

Another proposal is that the State might find the capital to finance a national supply scheme, leaving supply companies to operate it. In this way the benefit of State credit would be obtained without the disadvantages of State administration. Mr. Robertson is of the opinion, however, that such a proposal is open to serious objections, and would meet with the most strenuous opposition from existing authorities.

Mr. Robertson proceeded to deal with the movement recently inaugurated in Lancashire, in which he is keenly interested, for the interconnection of electrical undertakings.

It is not claimed that "linking-up" existing stations forms a complete solution of the electricity supply problem; it is claimed, however, that it offers an *immediate solution of the more pressing problems* and that it can be carried out at a minimum of cost in a reasonable period of time, thus opening up the way for a more comprehensive scheme of centralisation as soon as conditions become normal.

In the first place, by "pooling" all the plant in the various stations, the necessity for each station keeping spare plant of its own would be obviated.

Secondly, "linking-up" would provide within certain limits a valuable safeguard against interruption of supply. The value of "linking-up" from this point of view can hardly be over-estimated.

In the third place, considerable saving in fuel would be effected.

A further advantage of "linking-up" is that it would enable a certain number of stations to be shut down at week-ends and on holidays. Under existing conditions the 20 stations in the Manchester district have 20 staffs working every week-end; if the "linking-up" project is carried forward, four or five stations will suffice for the supply of the whole district during week-ends.

The technical difficulties may be passed over; it is undoubted that these can be surmounted. In two cases only frequencies other than 50 cycles per second have been adopted. The real difficulty is that of the "human factor," in which category certain engineers must be included as well as members of local councils, boards of management, &c.

It is the opinion of the lecturer that co-operation between existing authorities can only come about through pressure from outside; in other words, the assistance of the Government will be necessary.

The proposal in regard to the Lancashire and Cheshire scheme is that the Board of Trade should set up a district joint board or committee for the whole district, which would include representatives of the several organisations concerned in the scheme. It would be possible for a single municipal supply authority, whose area was situated adjacent to several others, to wreck the whole scheme if it refused to allow interconnecting mains to pass through its area. Such a refusal could be indirectly counteracted, however. The Local Government Board, being the sanctioning authority for all moneys spent by local councils, could refuse to sanction loans to the particular authority refusing to enter into the scheme, and in that manner practically force it to co-operate with the other authorities in the district.

In order to obtain the maximum economy, the joint board, or its committee, would have powers to determine the running hours of the stations on the system. The board would, of course, have power to raise capital to provide mains and transformers, and would also act in an advisory capacity to the Local Government Board in regard to extensions of existing stations. That is to say, they would have the power to decide which stations should be extended, and where new plant should be put down, having in mind the question of maximum economy.

The joint board should have absolute authority in settling prices. Provided the working costs and load factor of each station are known, it will be an easy matter for a technical committee of the board to decide what, under the circumstances, is a fair and proper price.

The scheme is for the benefit of the district as a whole, and the very greatest injustice that could possibly happen to an individual authority would be a trifling matter compared with the tremendous advantage to be gained by reducing the present wastage.

The principal advantage of such a scheme is that it would provide an easy road to centralisation. With such a scheme in operation it would be found beneficial for the small undertaking to take all its supplies from the common system and eventually shut down its own generating plant. One by one the inefficient stations would cease to generate electricity and would act instead as transforming and distributing centres.

If the scheme is put into operation now, it will probably be found 10 years hence that the whole of the area now supplied by 21 stations will be supplied by only four or five generating stations, which are favourably situated as regards coal supplies and condensing facilities. The authorities whose generating stations will be closed down will be able to sell energy in their districts at a price which could never have been realised if they had continued to operate their own plants.

This appears to be the direction of future progress in regard to electricity supply, and the plan offers a comparatively easy and efficient method of obtaining the advantages of centralisation without the financial burden which would have to be supported if all the existing stations were closed at once in favour of a new system.

Another advantage which the joint board will exercise will be the bulk purchase of materials, while standardisation of price over a large area will also be possible.

In the past we have suffered severely from an epidemic of cheapness—cheapness that has cost us, as a nation, infinitely more than the difference between the price we paid and the price we should have paid to ensure a fair profit to the manufacturer. It is sincerely to be trusted that the price of electrical plant for British stations will never again be fixed in Germany or in the United States.

* Abstract, from *The British Westinghouse Club News*, by permission.

BUSINESS NOTES.

Correction.—In the advertisement of the Klaxon Co., Ltd., appearing on page 14 of the Supplement of our last issue, the words "without flex and push" at the side of the block should not have appeared. The horn is supplied *with* flex and push.

Holidays.—The premises of the Sterling Telephone and Electric Co., Ltd., will be closed for business from December 22nd to December 26th inclusive.

Electrolytic Copper in Germany.—After discussing for some time past the question of establishing a German quotation for electrolytic copper in substitution for the London quotation, a recent conference of merchants and consumers held at the Berlin Chamber of Commerce decided to form an Association especially for this purpose. The chairman is Herr Peierls, of the A.E.G.,

and the vice-chairmen are Herr Dietz, of the North German Refinery, Hamburg, Norbert Levy, of H. Levy & Co., Berlin, and Herr Aschaff, of Basse & Seloe, Altona.

Private Arrangements.—THE TYLER APPARATUS CO., LTD., Banister Road, North Kensington, London, W., electrical engineers, &c.—In reference to this matter, particulars of which have already appeared in our columns, the following are creditors :—

Montefiore	£100	Cable Accessories Co.	£15
Walker, J. F.	108	Crypto Electrical Co.	46
Brit. Insu. & Helsby Cables, Ltd.	130	Canning, W., & Co.	74
Walker, J. F.	100	Finnis, Downey, Linnell and Chessher	568
Walker, J. F.	115	Braulik, G.	20
Essex Telegraph Co.	30	Baker, J., & Sons	40
Walker, J. F.	100	Brit. Insu. and Helsby Cables	229
Sun Electrical Co.	46	Brook, E.	54
Sun Electrical Co.	40	Carr, J. W., & Co.	20
Brown Bros.	34	Callender's Cable and Con. Co.	30
Walker, J. F.	100	Selson Engineering Co.	25
Dickson	212	Sun Electrical Co.	36
Carr, J. & W.	16	Smith, H., & Co.	24
Macnab, J.	254	Vacuum Oil Co.	22
Walker, J F.	100	Walters & John	26
Macnab, J.	200	Robertson's Motors, Ltd.	30
Walker, J. F.	100	Hall & Pickles	111
Walker, J. F.	100	Willis, N. W.	63
Walker, J. F.	120	General Rates	30
Temple Press	93	Willesden U.D.C.	40
Metro. Mfg. and Eng. Co.	17	Athol Garage, Ltd.	32
Mathews, F. C., & Co.	484	Brach, W. J.	53
Mathews Bros.	21	Hart, F G.	25
Moss & Gamble Bros.	19	Jee, F. J.	1,775
North British Rubber Co.	22	London United Tramways	750
Smith, W.	29	Nicholas, E. J.	290
Tyler Industries (Parent Co.	205	Pearson, G. W.	201
Farmer & Co.	36	Richard's Anti-Rust, Ltd.	20
Haywood, W. G., & Co.	25		

Norway.—As a branch of their business, the Aktie Selskab-Elektriak Industri have decided to set up a factory for the manufacture of conduits and fittings on the English system. The machinery has been ordered, and it is expected that the factory will be working in three months. The output capacity is 6 tons of pipe and fittings per day, which is expected to satisfy the whole requirements of the country.

Sweden.—Mr. Carl Rossander, the chairman of the Swedish Elektricitets-Vœrksforening, has advised the municipal members of his Union not to place their orders for electric cable and other accessories either in Great Britain or in Germany. He is obviously an advocate of absolute neutrality. The United States will, consequently, secure these orders.

Belgium.—H.M. Consul-General at Rotterdam reports that an agent at Bergen-op-Zoom, who formerly represented in Belgium and elsewhere a German electrical firm, desires to secure the representation in Belgium after the war of United Kingdom manufacturers of electrical material.—*Board of Trade Journal.*

Book Notices.—We note with interest in our esteemed contemporary *La Lumière Electrique*, that from January 1st that journal will combine with *La Revue Electrique*, and the two will appear in future as the *Revue Générale de l'Electricité*. The new weekly review will be the official organ of the Union des Syndicats de l'Electricité, and will be published at 12, Place de Laborde, Paris (8e), the subscription price being 40 fr. a year in France and 50 fr. abroad.

The fourth number of the *Journal* of the British Science Guild has now appeared. The *Journal* contains the recommendations of the Guild with regard to the establishment of a National Statutory Board of Science and Industry, a Report on the Reforms necessary in National Education, a Memorandum on the Encouragement of Teaching and Research in Science in British Universities, &c. Copies may be obtained from the Secretary, British Science Guild, 199, Piccadilly, W. Price 6d. each.

How to Avoid Accidents is the title of a handy pocket brochure issued by the British Dominions General Insurance Co., Ltd., of Royal Exchange Avenue, London, E.C., with the sub-title, "Instructions to Motor Drivers in Scotland"; it contains an excellent detailed set of instructions based upon official regulations and Acts, law cases, &c., which appear to cover all imaginable contingencies, and are so clearly worded, together with reasons why they are necessary, that they should prove invaluable to all owners of cars, drivers of motor-buses, and others responsible for the control of mechanically-propelled vehicles on public roads, and should afford effective aid in the development of the "Safety-first" campaign which has been inaugurated. A copy of the pamphlet is issued to the driver of every motor in Scotland that is insured with the company, and any interested reader can obtain one by applying to the author (their Edinburgh manager), Mr. W. T. W. Wells, 23, Danube Street Edinburgh.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXV. No. 12. December, 1916. New York : The Institute. Price $1.

"Memoirs of the College of Engineering, Kyoto Imperial University." Vol. I., Nos. 6 and 7. Kyoto : The University.

New Aluminium Works in Bavaria.—It is reported that negotiations have been concluded which aim at the establishment in Bavaria of a large aluminium works, with the co-operation of the firm of Giulini, of Ludwigshaven. The undertaking, which will bear the title of the Bavarian Aluminium Works Co., is to produce one-third of the total German consumption, and is to utilise the water powers of the Inn, where plant of 55,000 H.P. will be installed. The expenditure is estimated at £1,500,000, and the work of erection and equipment will occupy two years.

Machinery Users' Association (Inc.).—This Association held its annual meeting on Tuesday at the Windsor Hotel, Westminster, Sir Algernon Firth presiding.

British Industries Fair, 1917.—Application forms for space at next year's Fair are being issued by the Board of Trade. The event will be held from February 26th to March 9th, and as increased space is necessary, it will take place partly at the Victoria and Albert Museum, as last year, and partly in the Imperial Institute Building. The Fair will be confined to the same trades as last year. The Glasgow Municipality is, with the support of the Board of Trade, organising a Fair in Glasgow for the same time, but a few trades not covered in London will be included there.

Calendars.—From the SUN ELECTRICAL CO., LTD., of 118-120, Charing Cross Road, W.C., we have received one of their desk calendars for 1917. Under the difficult conditions now prevailing, the number available is limited, but applications on trade letter paper from those in the trade, who are not on the company's mailing list, will be attended to as far as possible. Sets of 1917 refill slips have been issued for the use of those already having the Sun base.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, has prepared its customary large wall calendar, showing three months on each page, the current month always appearing in larger form than the preceding and following ones. Each sheet carries a view of the works at Rugby and a half-tone illustration of some of the company's plant.

Roller Bearings.—MESSRS. BROOM & WADE, LTD., have received a contract for 350 Hyatt flexible roller bearings for line shafting, for installation in the new works in course of erection for the Daimler Co.

Catalogues and Lists.—THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—Quotation No. 53,210 tabulates and prices a great variety of wiring accessories, the prices for small and large lots being shown. Electrical contractors and others who are on the firm's mailing list will receive these quotations showing the prices ruling at the time of receipt. Other readers can have copies on application.

STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, London, W.C.—Publication No. 252 (16 pages) contains full descriptions, with illustrations, of the Sterling shaft signalling systems, with visual indicators, the apparatus being designed to comply with the new Home Office regulations in respect to electric signalling equipment in collieries.

Trade with Russia.—The paper by MR. W. H. BEABLE on "Russian Trade Opportunities and Methods," recently read before the Sales Managers' Association, together with the discussion thereon, is reprinted in pamphlet form (3d.), and copies can be obtained from the secretary, Mr. S. E. Talbot, 60, Wilson Street, Finsbury Square, E.C. The paper was fully abstracted in our issues of November 24th and December 1st.

Dissolutions and Liquidations.—ELECTRO-FLEX STEEL CO., LTD.—Creditors must send particulars of their debts, &c., to Mr. B. A. Fitzgerald, 82, Collingwood Buildings, Newcastle-on-Tyne, the liquidator, by January 31st.

W. W. OLDHAM & CO., electrical engineers, 7, Market Street, Hyde.—Messrs. W. W. Oldham and T. Bennison have dissolved partnership. Mr. Oldham will attend to debts and continue the business on his own account at the same address. Mr. T. Bennison will carry on business in his own name.

Bankruptcy Proceedings.—J. R. WHITEHOUSE, managing director of an electrical company, Golder's Green.—Application for debtor's discharge is to be heard at Barnet on January 23rd.

Trade Announcements.—The sole address of the PHONOPORE CONSTRUCTION CO., LTD., is now Phonopore Works, Southall, Middlesex. Concentration of the war-depleted staff at the factory will facilitate operations.

The firms of RATCLIFF & CO., of Marble Arch and North Audley Street, and RIDOUT & CO., 124, Regent Street, are amalgamating as Ridout & Ratcliff, Ltd., and will carry on business as electrical engineers at 42, Upper Baker Street, for the duration of the war. The firm will remove to larger premises in the West End on the conclusion of peace.

Owing to the present difficulty in obtaining supplies, it has been mutually agreed upon by the WANDSWORTH ELECTRICAL MANUFACTURING CO., LTD., Birmingham, and Mr. T. A. NUNWICK, of 4, Carr Street, Blackfriars, Manchester, to dissolve the agreement existing between them. This agreement will expire on 31st inst., after which date Mr. Nunwick will cease to represent them as their agent in Lancashire and Yorkshire.

LIGHTING AND POWER NOTES.

Arklow (Co. Wicklow).—The Town Commissioners are making an electric lighting installation on the northern quays; a petition has been extensively signed to extend the lighting to the southern quays. This, if undertaken, will involve the laying of a cable to bring the current across an arm of the bay.

Ashton-under-Lyne.—PRICE INCREASE.—The Corporation has given notice that after the current quarter the charges for electricity for lighting purposes will be increased by 1d. per unit over the pre-war rates.

Birmingham.—Plant Extension.—The Electric Supply Committee has now installed a further 6,000-kw. turbine set, and it is hoped that the full requirements of ordinary consumers and the tramways will in future be met.

Bognor.—The U.D.C. has decided to send to the B. of T. a protest against the decision of the Gas and Electricity Co. to make a minimum charge to all consumers of 13s. 4d. per quarter, on the ground that it is a direct incentive to extravagance to charge for current whether used or not.

Bray (Co. Wicklow).—The L.G.B. auditor has reported that there are considerable arrears in the Urban Council's electricity department, and he urges that more stringency should be observed.

Continental.—France.—It is reported that the closing of the shops in Paris at 6 p.m. has not made 5 per cent. difference in the consumption of electricity. Already several Paris companies have warned their consumers that henceforth the consumption of electricity and gas must be reduced by 66 per cent. The increased demands of the factories for electricity for power will render necessary strong measures if these are to be satisfied.

The Minister of the Interior recently announced that the restriction of public lighting had resulted in a saving in coal of 44 per cent.; as he regarded this as insufficient, a decree has been issued imposing on all municipalities a two-thirds reduction in public lighting as compared with the normal in the winter of 1913-14.

Norway.—The Ramnes District Council has decided to expend 200,000 kroner on the establishment of an electric power station. The Fredrikshald Town Council has decided to develop its recently-acquired waterfall near Brekke and Krappeto; 9,300 h.p. is to be generated at the turbine shaft. The total estimated cost of the undertaking, including the construction of a canal, is 2,174,000 kroner.

Croydon.—Price Revision.—The T.C. has adopted recommendations of the Electricity Committee to the effect that all consumers of current for power, whether using a time switch or not, taking less than 2,400 units a year, be charged for the first 600 units consumed each calendar year at 2½d. a unit, and all excess units at the rate of 1d. a unit, and that all time switches be removed where the consumption of at least 2,400 units during the year is not guaranteed by the consumer. In this way (the Committee explained) a large number of time switches will be rendered available to meet the requirements of large consumers for some time to come, and the work of the department lessened.

Dorking.—Price Increase.—The U.D.C. has received an application from Messrs. Edmundson's Electricity Corporation, Ltd., asking for the Council's sanction to a continuation of the 10 per cent. increase in the rates for electricity for the six months ending June 30th, 1917, and also that for such period a further increase of 10 per cent. should be allowed. The Finance Committee recommended a further increase in the rates of 5 per cent., making in all 15 per cent. Mr. Moore asked if the increase would apply to power users, as they already paid a 20 per cent. increase. Eventually the Committee's resolution, with the addition of the words, "for lighting only," was agreed to.

Dublin.—Mr. Andrew J. Sargent, in a letter on the Gas Co.'s action in raising the hiring charge of gas stoves, suggests that the company is influenced by the fact that the Corporation cannot at present obtain cable for the supply of would-be users of electricity. In several instances gas stove users have decided to substitute electric stoves and heaters.

Edinburgh.—The Corporation has been notified that the Ministry of Munitions is unable to grant permission to proceed with the electricity extension scheme at Portobello, or to alter the existing tramways system.—*Daily Express.*

Featherstone.—Prov. Order.—The U.D.C. has consented to a prov. order being granted by the B. of T. to the Electrical Distribution of Yorkshire, Ltd., for the supply of electricity, &c.

Fort William.—Public Lighting.—The Fort William E.L. Co., not being prepared to agree to the Council's suggestion that a rebate of 20 per cent. instead of 10 per cent. should be allowed on the account for public lighting under restricted conditions, the Council has agreed to the company's terms.

Glasgow.—The police stationed at two of the busiest crossings in the central parts of the city are being provided, as an experiment, with helmets to which are attached small electric lamps, energised by a battery carried in the pocket. The lamp shows the constable's position, and indicates to which of the lines of traffic the crossing is clear.

Grimsby.—The Electricity Committee has decided not to recommend the Council to insure against loss of revenue from the Corporation electricity undertaking arising from possible damage by military operations.

Haslingden.—The inter-supply of electricity between Accrington, Haslingden and Rawtenstall has been inaugurated. Originally the Accrington undertaking supplied Haslingden, but owing to shortage of plant, the arrangement has now been extended, so that Rawtenstall can assist in meeting the demands of Haslingden.

Hebburn-on-Tyne.—Street Lighting.—The U.D.C. has decided to discontinue the lighting of the street lamps until further notice.

Heywood.—War Bonus.—A war bonus of 2s. per week has been granted to the stokers, drivers, and motor and meter inspectors in the employ of the Corporation electricity department.

Huddersfield.—Price Increase.—Owing to the increasing cost of coal, the Electricity Committee has increased the price of electricity by another 12½ per cent. on the pre-war rate, the increase to come into operation on and as from date which the meters were last read for the current quarter expiring at the year end.

Kilmarnock.—Proposed Extensions.—The Corporation electrical engineer reported that Sir Alex. Kennedy had proposed installing a further 3,000-kw. turbo-alternator, but he (Mr. Bexon) advised that a 5,000-kw. machine be installed, so as to give a reasonable margin to spare. Mr. Bexon also points out that there is insufficient boiler capacity to deal with the load, and recommends that two or three Lancashire boilers be disposed of and that one Babcock & Wilcox boiler of 25,000 to 30,000 lb. capacity be procured. It has been decided to confer with Sir Alex. Kennedy on the subject.

Liverpool.—The Mersey Docks and Harbour Board has acquired 60,000 sq. yards of land adjacent to the wool warehouses abutting on Love Lane. It is suggested that electrical works in connection with the docks may possibly be constructed thereon.

London.—Islington.—The Lighting Committee has reported that the public street lighting was unsatisfactory, due to the difficulty of screening the powerful arc lamps. Experiments were made in the early part of this year with a view to substituting high-power incandescent lamps in certain thoroughfares. The Committee regrets that it will not be practicable to convert the greater number of the arc lamps in the borough, but steps have already been taken to ascertain whether it would be possible to use coloured glass shields in conjunction with the existing globes.

The Electric Lighting Committee has recommended a further increase of 10 per cent. in the charges for electricity, making a total increase of 25 per cent. on pre-war charges.

Fulham.—The Finance Committee of the L.C.C. has recommended the Council to sanction the borrowing of £11,000 by the Fulham B.C. for the extension of the boiler plant.

Poplar.—Electrolytic Disinfectant.—The Health Committee of the B.C. reports having considered the position of the electrolytic disinfectant undertaking. It appears that 51,120 gallons of the disinfecting fluid were distributed during the period from January 1st to November 30th, 1916. Payment was received in respect of 1,019 gallons supplied to local firms at 8d. per gallon and 868 gallons supplied to the works department at 1d. per gallon. The Committee does not consider it desirable to interfere with the free use of the disinfectant by residents, and at the Council Schools and military guard-rooms, but is of opinion the supplies to the Poplar Guardians, the baths, the libraries, and the works department should be charged at the rate of 8d. per gallon, in order that the cost may be debited to the appropriate account, and the disinfectant account credited accordingly. For the quarter ended September 30th, the units sold by the electricity undertaking have increased, as compared with the corresponding period last year, by 170,000, and the net income by £2,946. The working expenses, however, show an increase of £3,442, owing largely to the higher price of coal. The net surplus of income over expenditure for the quarter is £1,579, which the Electricity Committee considers, in view of present circumstances, to be highly satisfactory.

Loughborough.—Price Revision.—The Electricity Committee recommends that, as from December 31st, a further increase of 12½ per cent. be made to all consumers' accounts, including consumers under special contracts; the question of making a special charge to small consumers has been deferred till the end of the financial year.

Lowestoft.—The Electric Light Committee recommends that the Tramways and Electric Lighting Committee be amalgamated, and to include the whole of the members of both Committees, under the title of the Electric Works Committee. The Council adopted the recommendation.

Nottingham.—According to the *Nottingham Guardian*, the city electricity undertaking was severely criticised recently at the University College. The *Guardian* says that the plant is out of date, and ought to be scrapped, but that the Committee is limited financially owing to having surrendered much of its profit each year, instead of building up a larger reserve. The cost of electricity at the present time is said to be a hindrance to the prosperity of the city, against which the rate relief obtained from profit has to be considered.

Otley.—E.L. Proposals.—The U.D.C. has decided to support the application of the Electrical Distribution of Yorkshire, Ltd., for a provisional order to supply Otley and district with electricity, and has instructed its representatives accordingly. One reason for the sudden reversal of the policy adopted in the past is said to the poor quality of the gas now supplied in the town.

Paisley.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking for the year to May 25th last show that 4,504,593 units were sold, 1,793,000 being supplied to the tramway company and nearly as much for power and heating. The maximum observed load was 2,302 KW. The gross revenue amounted to £31,349, and the gross profit to £12,223; and after meeting financial charges, there was a surplus on the year's working of £337.

PRICE INCREASE.—The T.C. has decided to increase the charge for electricity for lighting by ½d. per unit; a new scale of charges for power supply has also been approved.

South Africa.—According to the annual report of the Government Mining Engineer, the total value of new machinery and plant introduced during 1915 amounted to £606,682. Included in the chief items are boiler plant, other than that of locomotives, traction engines, or steam wagons, £7,348; electric generators and engines, hoists, locomotives, and motors, £90,143; power lines, transformers, bells, telephones, &c., £79,180. The most important items comprise stamp mills and tube mills for the new mines on the Eastern Rand, winding plants for these mines, electric winders for other mines, and increases in the electrical plant at central power stations.

The following table shows the total units disposed of during the year by the power stations of Corporations and Municipalities, and by public supply companies in the S.A. Union. The units used for mining purposes, out of the total shown in the table, amount to 533,546,468 electrical and 147,928,535 compressed air units. The outputs of the power plants on the mines are not included in the table:—

	Direct.	Alternating.
Transvaal...	22,820,266	707,212,164†
Cape	17,356,043	22,426,823
Orange Free State ...	599,186	1,834,063
Natal	8,086,758	12,047,005
Total for 1915 ...	48,863,153	743,520,055
Total for 1914 ...	46,168,510	603,286,880‡
Total for 1913 ...	42,490,911	555,181,027*

† Includes 147,928,535 units of compressed air.
‡ Includes 121,014,096 units of compressed air.
* Includes 123,081,136 units of compressed air.

—*South African Mining Journal.*

Sunderland.—PLANT EXTENSION.—At a meeting of the T.C., it was reported that the Electricity Committee had accepted tenders for the ensuing year for the supply of coal of a much better quality than they had been using lately, and he believed that the improvement in quality of fuel would prove a remedy to the nuisance caused by the emission of smoke. The Treasury had agreed to the Corporation undertaking an extension of the Hylton Road works at a cost (estimated) of £45,000, and the Committee had accepted a tender for the supply of a new turbine set, which formed part of the scheme. The cost, however, would be substantially higher than pre-war prices. The report was adopted. It was also decided to extend the E.H.T. mains.

The Electricity Committee has recommended that the T.C. contribute £50 towards the cost of the action brought against the Hackney B.C. by the Gas, Light, and Coke Co. in connection with the charges for the supply of electricity.

Swansea.—The borough treasurer and the borough electrical engineer have been considering the best means of encouraging the supply of electricity to houses and premises where the occupiers are unable or unwilling to bear the initial cost of installation, and have now decided upon a scheme. It has been resolved that a fee of 5s. be charged in the following cases:—(1) Connecting up a supply after the same has been disconnected through non-payment of account; (2) for testing meters if, when such test is made, it is found that the meter is correct. The Public Health Committee is to install at the hospital electrical apparatus for cooking and heating, at an estimated cost of £20. The installation is expected to be of great assistance in times of stress and shortage of labour.

Thirsk.—STREET LIGHTING.—The Northern Counties Electric Lighting Co., in view of the Council's notification that there would be no public lighting required for the 1916-17 season, has asked the Council to make an allowance on the basis of a one year's contract. The Council has pointed out that the three years' contract was subject to the necessary money being voted by the parish meeting, which had decided against it.

U.S.A.—THE NIAGARA POWER SITUATION.—With further reference to this question, which was discussed in our issue of September 1st last, it is evident from a recent *Electrical World* article, that the threatened diversion of Canadian Niagara exported power from American to Canadian use is coming to pass. The journal states that about three months ago the Ontario Government was asked for additional power by several Canadian factories, and a demand was made upon the Canadian Niagara Power Co. for a larger supply. The company agreed to furnish 50,000 H.P. after a threat had been made to stop all exportation. The Canadian Niagara Co. is only supplying 35,000 H.P., and the Commission has demanded the additional 15,000 H.P. at once. Already an embargo has been placed on more than 18,000 H.P. formerly sent to Buffalo and other western New York cities, with the result that American generating companies have been unable to fill the increased demands made upon them. The maximum supply received in Buffalo is 78,500 H.P., but it was estimated that some 90,000 H.P. would be demanded this month, and it is expected that the first unit of the Buffalo General Electric Co.'s steam plant, of approximately 25,000 H.P., will be operating this month. In order to meet the immediate demands, the Secretary of the U.S.A. War Department has authorised the Niagara Falls (N.Y.) Power Co. to divert an additional 1,400 cb. ft. of water per second from the river during the peak load hours in the morning and afternoon; this permission expires on January 1st next. It is stated that many Buffalo industries have had to close down, and that both public and private lighting has been restricted.

According to the *Central Station*, the number of ranges on the Boston Edison lines is nearing the 1,000 mark, and the company's cooking load is approximately 5,000 KW. Many of the finest apartments are being electrically equipped throughout.

Worcester.—The Town Council has decided that, in order to furnish a local firm with a three-phase supply up to 250 H.P., additional mains be laid at a cost of £270, in addition to the purchase of the 100-KW. transformer at £180. An increase in revenue of £160 to £200 per annum is expected, and if the scheme which it was understood was under consideration for largely increasing the electrification of the works was proceeded with, the revenue would be increased by £500 per annum. An application was received from another firm for a considerably increased supply of electricity, and they have been informed that the Committee could not spend £2,500 for temporary work, but owing to the increased demand in other directions, if the firm will undertake to contribute £1,800 towards the necessary expenditure, the Committee would be prepared to recommend the Council to undertake the work. The proposal was to be brought before the Council at the next meeting.

TRAMWAY and RAILWAY NOTES.

Australia.—The official opening of the Melbourne, Brunswick and Coburg electric tramway took place recently. A portion of the system has been in operation for some time, but the official opening had been deferred until the completion of the whole scheme. The cost of the undertaking is approximately £150,000, borrowed from the Commonwealth Bank at 4½ per cent. The journey from terminus to terminus takes 28 minutes, and a six-minutes' service will be maintained during the busy portions of the day.

Birmingham.—It has been decided to give a curtailed tramway service on Christmas and Boxing Days.

Continental.—GERMANY.—According to a London daily, all the German tramway lines are to be placed at the disposal of the War Department for the transport of goods needed by that department. Hitherto the tramways in practically all the German cities have stopped running for public use at 10.30 p.m., and have been used from 11 o'clock p.m. till 5 a.m. by the War Department. It is probable that in some of the large cities like Berlin the time limit will be made earlier.

NORWAY.—The Committee of Stavanger has issued an instruction for the laying of a coast railway to start from Hinna and end with a junction with the Jæder line at Næbo. The line is to be built for electric driving, and will be undertaken as soon as possible.

Darlington.—HALFPENNY FARES.—Halfpenny fares on all routes are to be suspended after 1 p.m. on Saturdays.

Doncaster.—WAGES.—The Corporation tramway employés (members of the Tramways and Vehicle Workers' Association) have applied for an advance of 1d. per hour; the offer made by the Corporation of a slight increase on the minimum rate has been rejected.

Edinburgh.—According to the *Glasgow Herald*, the T.C. has resumed its negotiations for the purchase of the Edinburgh and District Tramway Co.'s rolling stock at the termination of the lease. The company has now offered to sell its 250 cars for £50,000, and to be responsible for the upkeep of the tramway for six months after the termination of the lease.

Hull.—HALFPENNY FARES.—The Tramways Committee on Wednesday last decided to discontinue halfpenny stages as a war time economy. The working expenses since the commencement of the war have gone up £20,000 and the bonuses amount to £10,000.

Preston.—COLLISION.—As a result of a collision between two cars, through one jumping the rails on Saturday, 10 persons were injured and required treatment at the local infirmary.

Rochdale.—The tramway workers have been agitating for a substantial increase of wages for all grades, and notices were tendered to expire on December 16th, but the men have since agreed to submit the matter to arbitration by Sir Geo. Askwith. Similar applications have been made to various tramway authorities in Lancashire and Cheshire, and Rochdale has joined a conference of these in asking the Committee on Production to arbitrate on the demands.

Salford.—Strike.—The appointment of women inspectors on the Corporation tramways has led to a strike of drivers and male conductors, who decided to cease work at midnight on Saturday. On Monday night, after negotiations which lasted all day, the men accepted the Tramway Committee's suggestion that the matter in dispute should be referred to arbitration by the Committee on Production, and that pending the decision of the arbitrators the women inspectors should be withdrawn from the cars. The men agreed to report for service on Tuesday morning, and the car service, it was officially announced, would be then resumed.

Sheffield.—Electric Vehicle Economy.—Councillor Roberts, in moving the minutes of the Health Committee, stated that the cost per ton of collecting refuse by electric vehicles was 3s. 1d., as compared with 3s. 9d. by horse labour. Electric vehicles were a great economy at the present time, especially as the cost of horse-feed had risen considerably in price.

Southport.—Wages.—The tramway wages question has been settled; the T.C. has agreed to an all-round advance to both motormen and conductors.

South Lancashire.—The tramway services in Manchester and surrounding districts were greatly disorganised on Friday and Saturday, owing to the dense fog which prevailed.

TELEGRAPH and TELEPHONE NOTES.

Glasgow.—At a meeting of all grades of postal, telegraph, and telephone supervising officers, it was unanimously agreed to press for a substantial all-round increase of salaries.

Newcastle.—Local shipowners have offered to subscribe £2,000 towards the establishment of a school of wireless telegraphy.

Wireless Patents in the U.S.A.—According to the *Electrical Review and Western Electrician*, on October 12th a perpetual injunction was issued against the Marconi Wireless Telegraph Co. of America, prohibiting it from infringing the patents owned by the De Forest Radio Telephone and Telegraph Co., covering the De Forest Audion detector or amplifier. The litigation involved particularly Claims 4 and 6 of Patent No. 841,387 for "Improvements in devices for amplifying feeble electrical currents," issued January 15th, 1907; also Claims 2, 3, 6, 14, 18, and 21 of Patent No. 879,532, entitled "Improvements in space telegraphy," and issued on February 18th, 1908. Both these patents were found valid and sustained.

Wireless for U.S. Transmission System.—The Southern Sierras Power Co., operating in Southern California, has adopted wireless service between its different generating plants and substations. The company's system extends from Bishop to Calexico, a total distance approximating 400 miles; five hydro-electric power plants are located in the vicinity of Bishop, with a steam turbo-generating station of 11,000-H.P. capacity at San Bernardino. The northern plants are located in rugged country, subject to severe weather conditions, and causing considerable difficulty from time to time in maintaining communication over metallic circuits. Two sets of radio equipment have been installed in important stations on the main transmission system with highly satisfactory results, and it is planned to provide all the other stations with similar apparatus, in order that radio communication may be effected with every necessary point throughout the system.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—January 2nd. Small pea or bean coal (1,000 tons), for the U.D.C. Electricity Department. Mr. F. Garside, Electrical Engineer, Laburnam Road.

Australia.—Sydney.—January 22nd. Electrical plant (converter, battery, booster, and switchboards) for the Castlereagh Street sub-station, for the Municipal Council. Specification from E.L. Department, Town Hall.*

February 19th. Municipal Council. Meters, maximum demand indicators, feeder regulators. Specification from E.L. Department, Town Hall.

January 1st. P.M.G.'s Department. Cords, switchboard parts and accessories, measuring instruments and telegraph instruments. See "Official Notices" December 1st.

Perth.—January 10th. P.M.G.'s Department. Telephone instruments and parts. See "Official Notices" December 15th.

Cape Town.—January 5th. Electric motors and starting panels, for the Corporation Electricity Department. Dock Road, Cape Town.*

Durban.—January 3rd. Corporation. One 3,000-KW. steam turbine, alternator, and condensing plant. Specification No. S 238 and drawing No. P 597, both at the office of the Borough Electrical Engineer, Municipal Buildings. Deposit £2 2s.

Johannesburg.—January 3rd. Corporation. Iron axles and bushes.*

Liverpool.—December 28th. Electrical supplies for three months, for the Toxteth Park B. of G. Mr. R. A. James, Clerk, 15, High Park Street.

Manchester.—December 28th. Corporation Electricity Committee. Water-tube boilers and induced-draught plants for Stuart Street station. Specifications, &c., one guinea (returnable), from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

New Zealand.—Dunedin.—January 24th. Motor-generator, accessories and spares. City Electrical Engineer, Market Street, Dunedin.*

Tauranga.—February 12th. Borough Council. Supply of six three-phase transformers. 11,000-400 volts. Messrs. H. W. Clime and Sons, Consulting Engineers, Raetihi.—*N.Z. Shipping and Commerce.*

Spain.—Tenders have lately been invited by the municipal authorities of Montejo (Province of Badajoz) for the concession for the electric lighting of the town during a period of eight years.

Wigan.—January 8th. Tramways Committee. 30-H.P. motor tower-wagon. Mr. Frank Buckley, General Manager, Market Place.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Government Contracts.—List of new contracts placed during November, 1916:—

War Office.

Motor-alternator.—Phœnix Dynamo Mfg. Co., Ltd.
Electric light fuse bases and carriers.—Dorman & Smith, Ltd.; W. White and Co.
Bridge meggers.—Evershed & Vignoles, Ltd.
Electric cables.—General Electric Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & India-Rubber Works, Ltd.
Electric cells.—J. C. Fuller & Son, Ltd.; Siemens Bros. & Co., Ltd.
Motor-converters.—Bruce Peebles & Co., Ltd.
Ebonite rod and sheet.—Bristol Ebonite Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Fans (extracting).—Sturtevant Engineering Co., Ltd.
Electric light fittings.—General Electric Co., Ltd.; S. Heath & Sons, Ltd.; C. H. Parsons, Ltd.; G. Roe & Sons, Ltd.; Sun Electrical Co., Ltd.; Veritys, Ltd.
Generating sets.—Austin Motor Co. (1914), Ltd.; Coventry Engineering Co., Ltd.; Keighley Gas & Oil Engine Co., Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.; Cryselco, Ltd.; Dick, Kerr & Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; Imperial United Lamp Co., Ltd.
Telegraph poles.—Cook, White & Co.
Switches.—Berry & Hayward, Ltd.; Park Royal Engineering Works, Ltd.; Sperryn & Co., Ltd.; W. White & Co., Ltd.
Electrical instruments, terminals.—Automatic Standard Screw Co., Ltd.; Davis & Timmins, Ltd.; D. Gilson & Co., Ltd.; Ingram & Kemp, Ltd.; W. McGeoch & Co., Ltd.; Sperryn & Co., Ltd.
Electric torches and parts.—British Ever-Ready Co., Ltd.; Edison Swan Electric Co., Ltd.; Efandem & Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.; C. Twigg & Co.; Vulco Battery Co.; Westwood Electrical Co., Ltd.
Works services.—Electric light installation at Bramham Moor: G. E. Carr. Electric light installation at Narborough: Ellis & Ward, Ltd. Electric lights, &c., at Turnhouse: A. Arther & Ure.

India Office Store Department.

Pots.—General Electric Co.
Superheater parts.—Superheater Corporation.

H.M. Office of Works.

Engineering works.—Supply of engineering labour in day-work during a period of one year from January 1st, 1917, in Bristol: The Colston Electrical Co.
Electric wiring.—Foote & Milne, Ltd.

Post Office.

Protective apparatus.—Phœnix Telephone & Electric Works, Ltd.
Telegraph apparatus.—I.R., G.P. & Telegraph Works Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works Co., Ltd.; Western Electric Co., Ltd.
Tubular telegraph arms.—Siemens Bros. & Co., Ltd.
Submarine cables.—Telegraph Construction & Maintenance Co., Ltd.
Pole brackets.—Bullers, Ltd.
Telegraph cables.—B.I. & Helsby Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.
Insulators.—New Gutta-Percha Co., Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Solder.—E. Austin & Sons.
Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.
Stay swivels.—Bullers, Ltd.
Bronze wire.—B.I. & Helsby Cables, Ltd.; F. Smith & Co. (incorporated with London Electric Wire Co. & Smiths).
Tinned-copper wire.—B.I. & Helsby Cables, Ltd.
Galvanised-iron wire.—Whitecross Co., Ltd.
Steel wire.—Whitecross Co., Ltd.

London.—Camberwell.—The B.C. has extended for one year, from March 31st next, its contract with the Private Telephone Co. for the maintenance of private telephones.

Barnes.—U.D.C. Laying 600 yards of cable: Macintosh Cable Co., £289.

New Zealand.—Wellington.—Public Service Stores Tender Board. Accepted tenders:—

2,000 cords (4-conductor) for microtelephones, without switch, £178; 1,000 ditto, with switch, £88; 3,000 ditto, with switch, £270.—P. R. Baillie and Co.
1,500 switchboard plugs, £212; 2,500 ditto, £346.—B. L. Doune.
2,000 red and 2,500 white conductor cords, £609.—P. R. Baillie & Co.
1,000 extension bells, 1,000 ohms, £406.—B. L. Doune.

—*New Zealand Shipping and Commerce.*

NOTES.

Christmas, 1916.—We have received a specimen of the greetings card which is being sent to all members of the I.E.E. who are on active service. It reads as follows :—

"The President and Council and the Members of the Institution of Electrical Engineers send hearty greetings to all members of the Institution on Active Service, and wish them God-speed and a Happy Return.

"Christmas, 1916."

THE ELECTRICAL REVIEW also wishes to tender appropriate good wishes for Christmas and the New Year to all of its readers with the Forces on land and sea, far and near, as well as to the host of munition workers in electrical works who have been rendering strenuous service to the nation for so long, and have well earned the few days of rest that the holidays will afford them.

Visit of Journalists to Liverpool and Manchester.—The visits of journalists to Leeds and Sheffield which took place in October, and which were most successful, were supplemented on December 10th-13th by visits to Liverpool and Manchester. A reception of the representatives of the Manchester journalists on the evening of the 10th was followed on Monday, the 11th, by a visit to the University of Liverpool, where the party were received by Prof. Herdman (in the absence through illness of Vice-Chancellor Sir A. Dale), who, in a concise address, enlarged upon the importance of the work that was being carried on by scientific journalists, and also stated that the value of research work had been specially brought to the notice of the Government, and the latter (represented by Lord Crewe) had expressed great readiness to forward the views of the deputation. Prof. Herdman laid special stress upon the importance of research work with regard to the unforeseen results which might accrue from it, the value of which could not be foretold, but which were bound to be important; the help which scientific journalism could give in the matter was very considerable. The party were then conducted over the University, and shown the various technological and other departments; that of tropical medicine excited special interest, the bearing which it had upon the possibility of carrying out industrial enterprises in districts, where malaria had hitherto prevented the importation of labour, being pointed out.

Proceeding to Manchester the same day, the party received representatives of the Manchester Press, and next day were received at the University of Manchester by Vice-Chancellor Sir Henry Miers, and conducted over the buildings, the magnitude and completeness of which in regard to the scientific subjects dealt with from an educational point of view were very striking. The party were then entertained at luncheon by the Lord Mayor, who, in welcoming the journalists, stated that the union of scientific journalism with University technological teaching was to be strongly advocated. A visit to the Technological School followed. The comprehensiveness of the equipment of this school in reference to the number of industrial trades dealt with was very noteworthy. The day's proceedings terminated with a dinner given by the University authorities.

A marked interest in the proceedings was unmistakably evinced by the University authorities, and a full recognition of the help which trade journalism could give to the technological side of the Universities was shown. Whether the technology teaching is taken advantage of to the full extent desirable may be questioned, in view of the fact that the attendance at either Liverpool or Manchester previous to the war was but little over 1,000, although the annual fees for a complete course do not exceed £21. For the son of a working man, however, this amount may be prohibitive, and at Birmingham something is being done to bridge over the difficulty. The help which trade journalism may give to the Universities in enabling increased grants to be obtained from the Government, so as to enable fees to be reduced, and scholarships be provided, may be very considerable; certainly a good start has been made.

On Wednesday most interesting visits were paid to the British Westinghouse Co.'s works, and also to the works of the Ford Motor Co., the organisation of the latter being especially noteworthy.

A tribute should be paid to the chairman of the party, Mr. Leon Gaster, who is working most energetically for the promotion of University research and technological work, and who is also enabling technical journalists to know more of each other.

Electrical Music.—The "America's Electrical Week" Committees included music in the scope of their activities, and co-operated with manufacturers of electrically-driven musical instruments in arranging electrical concerts. Mr. E. A. Sperry, president of the New York Electrical Society, estimated that the connection of the two million pianos in America with the supply mains would represent a possible demand of some 200,000 H.P.

Industrial Organisation for After the War.—Some months ago, some 300 firms in the Scottish iron, steel, and allied industries met in Glasgow, and passed a resolution in favour of bringing these industries together in a strong central organisation to deal with post-war questions "in a comprehensive and Imperial manner." A Committee was appointed to consider what should be the nature, scope, and object of the organisation.

This Committee, according to the *Times*, has now issued a report. It points out that increased production will be the greatest factor in national prosperity after the war, and that it can be attained only by a more cordial co-operation between employers and workpeople; by efficient equipment and organisation on the one hand, and on the other, by the abolition of all restrictions and practices limiting output. To secure mutual confidence, some form of payment by results, with basis rates, will be needed; and the workman should have some security that increased earnings following increased production will not be made a ground for rate-cutting. At the outset, therefore, any organisation of the industries should be prepared to co-operate with labour. Subject to these general considerations, continues the *Times*, the following are indicated as the objects of any central organisation :—

"To direct the attention of the Government and its Departments, for their information and guidance, to matters requiring consideration and action in the interests of the industries concerned, and to initiate and review legislative proposals on commercial, industrial, and economic matters.

"To deal with questions affecting the labour conditions and internal organisation and disabilities of the industries concerned, with a view to securing increased efficiency from an Imperial and national point of view.

"To educate and inform public opinion."

The report sets out many examples of the questions which might have to be dealt with, among them being the question of means of giving workpeople a continuing interest in the prosperity of the industry which employs them, and the question whether some method of making Associations of employers and employés responsible for their members should be adopted,

The central organisation, the Committee suggests, should be a national advisory Council of Industry, consisting of a body of elected representatives of employers and a body of elected representatives of employés who might meet separately or jointly. The joint meeting should be presided over by a Minister of Industry.

Local Councils, the report states, might be desirable for the large industrial areas. Finally, the Committee recommends that a further Committee should be set up to carry these general principles into effect, and that it should proceed step by step in consultation and conjunction with representatives in other districts of the industries concerned.

Tramway Employes' Wages.—An application put forward by employés in the traffic section of the London County Council Tramways for an increase of 15 per cent. on all current rates of wages formed the subject of arbitration proceedings at the Chief Industrial Commissioner's Department, Westminster, last week. The claim was based on the ground of the higher cost of living, and over 5,000 workers were affected, including drivers, male and female conductors, and pointsmen. A concession of 2s. a week, in addition to the existing war bonus of 3s., and 6d. for each employé's child under 14 years of age, was offered by the L.C.C., but this offer was declined. Evidence on both sides was heard at considerable length. The proceedings were conducted in private. The decision of the arbitrators will be communicated to the parties interested after a full consideration of the evidence.—*Morning Advertiser.*

Sweden's Electrical Industry.—The rise of Sweden's electrical industry was the theme of an address by Mr. C. A. Rossander before a recent joint meeting of the Swedish Elektricitetsverkforening and the Norse Elektricitets-vœrkers Forening. The industry, said the speaker, divided itself into two groups—(B) Electricity works supplying lighting and power within a limited sphere, and (A) Power stations which generated and distributed at high pressure over wide areas. At present, of Sweden's 101 towns, nine only, and those among the smallest, were without an electric station, and with those the question was even now on the orders of the day for early settlement. Dealing with the (B) statistics in detail, the figures for the years 1905 to 1914 show that the works aggregate capacity rose from about 21,000 KW. in 1905 to about 125,000 KW. in 1914; the total installation costs from about 17,000,000 to about 69,000,000 kroner, or an average of about 550 kroner per KW.; the energy production from about 20,000,000 to something over 140,000,000 KW.-hours; while the total gross income rose from about 6,000,000 to nearly 17,000,000 kroner, or about 24·6 per cent. of the installation costs. In ten selected towns, the consumption per head advanced from under 20 to about 47 KW.-hours. The latest figures show a tendency to approximate to the possible maximum of 50 to 55 KW.-hours per head. One feature in connection with these works is worthy of special mention—the increase in the employment of water power. Of the 79 electricity works in the statistics for 1914, only 18 did not employ water power either alone or in conjunction with thermal power. Sweden's leading municipal power station—that of Stockholm—has hitherto produced all its energy by steam; but it is now taking steps to meet its needs from the water-power installation on the Dal River.

In the period under review—1905 to 1914—the price charged for electric lighting fell from about 41·5 öre per KW.-hour to 34·5 öre, or 17 per cent.; for motive power, from about 26 öre to below 19·25 öre, or about 26 per cent. At the same time, the receipts rose from less than 9,000,000 kroner to about 16,000,000 kroner.

Passing to the large power generating installations, or "A" works, the power transmitted, as well as the pressure, increased rapidly; 1907 saw an installation at 40,000 volts, and 1909 one at 50,000 volts, and an installation with a pressure of 80,000 volts has been put in operation. Up to 1914 concessions had been granted for a total of nearly 7,000 KW. of high- and medium-pressure lines, among which were included lines belonging to electric works not delivering energy for sale. In 1914 the total plant capacity installed was about 160,000 KW., and the annual energy production was about 465,000,000 KW.-hours. Installation costs stood at about 73,000,000 kroner, or an average of 445 kroner per installed KW. Taking A and B works together, the figures worked out at—total installed capacity 285,000 KW. and total energy production 550,000,000 KW.-hours. Most of the energy produced by A works goes to industries.

Cost of Electric Welding.—The accompanying data on repair costs due to electric arc welding have been compiled by the Westinghouse Electric and Manufacturing Co. from the shop records of railroad companies. One company which has kept continuous records of the savings made by arc welding reported that the total cost of welding by this process during one week was $106·62, while the total cost of the same work if done by other means would have been £1,779·04, representing a net saving of $1,672·42 in favour of arc welding. In addition, a great saving in time was made. In another case, where an entire firebox had to be taken out, the work, including 35 ft. 7 in. of linear cutting, was done in 38 minutes with approximately 500 amperes.

Relative Cost of Electric Welding in Repair Work, in Dollars.

Nature of damage repaired.	Electric arc welding.				Old method.		
	Energy.	Labour.	Material.	Total.	Labour.	Material.	Total.
Cracked door sheet on firebox	0·09	0·30	0·12	0·51	30·00	24·00	54·00
Cracked side sheets and door sheets in fireboxes ..	—	—	—	4·23	—	—	24·35
Cracked crown sheet	—	1 hr.	—	0·36	30 hr.	—	75·00
Broken frame ..	—	7 hr.	—	3·29	12 hr.	—	14·73
Worn wrist pin ..	0·10	0·75	0·15	1·00	—	—	35·00
Cracked steel bolsters	0·54	5·42	0.75	6·71	—	—	54·00
Cracked guide yoke..	0·07	0·45	0·10	0·62	—	—	47·00
Cracked mud ring ..	0·27	1·95	0·37	2·59	16·20	13·00	48·20
Five draw-head stops	1·30	1·15	0·18	2·63	—	—	22·20
Broken cylinder ..	0·80	0·65	0·11	1·56	9·80	4·00	13·85

—*Electrical World.*

Lighting the Statue of Liberty.—The idea of flood-lighting Bartholdi's Statue of Liberty, New York, was conceived in 1915, and a fund was raised for the purpose by subscription. Mr. H. A. Magdsick, who was responsible for the flood-lighting of Woolworth Building, was entrusted with the task of designing an appropriate scheme of illumination, and Mr. R. F. Carbutt, of Henry L. Doherty & Co., took charge of the structural and electrical designing. The actual work of assembling equipment began late in October, and it was decided to inaugurate the permanent flood-lighting on December 2nd, the opening day of America's Electrical Week. It was decided to intensify the torch light. It was decided to transform the dull lantern into a flaming torch effect, and Mr. Gutzon Borglum was engaged to supervise the remodelling. The somewhat rude steel work which supported the range light, was removed, and in its place sheet bronze was used to re-design the torch in the shape of a "flame" of the form and size originally intended by Bartholdi. When the restored torch-flame was completed, all the bronze plates were cut out, leaving as a skeleton riveted lines about an inch in width. These plates were then used to construct moulds upon which 600 pieces of glass were bent; these pieces, when fitted in place, forming a glass torch held together by the bronze skeleton.

Mr. Borglum selected three tones of yellow cathedral glass. A dull surface was preferred, to avid the blinding noon-day glare of a highly reflective surface. The lightest tint was used to simulate the tip of the flame, with slightly darker pieces inserted here and there variously down to the base of the flame, where the darkest of the tints define the lines of the bronze of the torch against the glass of the flame. The pieces of glass average about 1 ft. sq., making a complete glass area in the torch of some 600 sq. ft. The glass is so fixed to the ribs that any section may be replaced at any time from the inside. A lighthouse lens is fixed in the torch, and will contain about 20,000 c.p.

Finally, to put "life" into the simulated flame of the burning torch, about 15 500-c.p. gas-filled electric lamps will be placed upon a series of flashers, to produce the unsteady, but constant, flicker of the torch.

The sources of the flood-lights are 15 batteries of projectors, the total number of projectors is 246, each being of 250 watts. The lamps are 35-volt lamps, and each of the projectors has its individual compensator to step down the 220-volt current to the lamp voltage.

We are indebted to the Society for Electrical Development for the foregoing particulars.

Russia: The 1886 Company: Swiss Protest.—According to the *Novoie Vremya*, the Swiss shareholders in the 1886 Company are alarmed to learn that the concern is indeed to be wound up, and have applied to the Minister of the Interior, A. D. Protopopoff, with a memorandum, expressing their confidence that the Russian Government, through the Council of Ministers, will reject the project of the Committee for Suppressing German Control which has decided for the liquidation, and that it will not allow any change in the rules made *re* the 1886 Company last year. Besides, the Swiss shareholders affirm, again, that most of the shares are not in German hands, but are in the hands of Swiss citizens. In conclusion, the memorandum commends the impartiality of the Minister of the Interior, who they hope will not permit the injustice of the liquidation of the company. The memorandum has been handed to the President of the Council of Ministers.

A Large Battery Installation at Winnipeg.—A special battery building has recently been constructed by the Winnipeg Electric Railway Co. to house a 5,000-ampere-hour storage battery, which is to be used for stand-by railway service and for improving the station load factor. The building is 41 ft. wide × 196 ft. long and 16 ft. high, and provides space for a fan room 41 ft. long × 12 ft. wide × 10·5 ft. high at one end, and for a switchboard room at the other end. The foundations are of concrete, the roof of double concrete with 3-in. air space and four monitor roof ventilators, supported by reinforced concrete pillars. The floor is made of vitrified brick pavement with asphaltum filler laid on an 8-in. concrete base having a fall of 17 in. from one end to the other. The building is ventilated by an indirect steam heating system, air being forced through steam heated coils into concrete ducts running longitudinally the entire length of the building, allowing air to circulate up into the battery room and out through the monitor ventilators.

The battery is of the Tudor type with a rating of 5,000 ampere-hours. There are 286 cells, each composed of 85 plates of 18⅛ in. × 18⅛ in. in lead-lined wooden tanks, each supported on 10 oil-insulated porcelain supports. The terminal cell connections are made of lead-coated copper bus.

A compensating and recording hydrometer installed in a lead-glass case gives a constant record of specific gravity, and also indicates by means of a bell alarm to the switchboard operator when a certain charging point has been reached.

In conjunction with the battery there is installed a 3,300-ampere, 175-volt, inter-pole type booster set.

The battery is protected by a 6,000-ampere, 650-volt, circuit-breaker mounted on a reinforced marble board. A single-pole, double-throw switch allows the battery to be operated in conjunction with the booster, or in case of emergency to be thrown directly across the railway bus.

In case of emergency, such as a shut-down on the transmission line, the battery is immediately thrown directly across the railway bus and keeps the cars in operation long enough to allow the operators to get the railway machines back on the line again. On one or two occasions when the battery has been directly across the railway bus, discharges as high as 9,000 amperes have been observed by the operators.

The battery is kept floating on the line continually, and is of great assistance on peak loads. The charging of the battery is done mostly at night when the cars are not in operation.—*Electrical World.*

Sheffield's Future.—The *Times* states that the Sheffield City Council, last week, discussed the appointment of an Industrial Development Committee. The Deputy Lord Mayor said the city, by the great enlargement of its electricity undertaking, was making provision for the future, and it was necessary, if they wished Sheffield to retain its present foremost position, that they should do all they could to develop its industries. A Committee was appointed to deal with the subject.

Overhauling a Big Set.—The Commonwealth Edison Co., of Chicago, recently performed what must be considered a feat of speed. The 30,000-kw. turbo-generator at the Northwest station was shut down at midnight on a Saturday for its annual cleaning and overhauling, which includes opening, inspecting, cleaning, renewing worn turbine blades, and replacing practically the entire auxiliary water-handling system of turbine and pumps. The condenser had also to be cleaned, and about one thousand tubes removed and replaced. This was done, and everything replaced, and the machine made ready for service within 70 hours.

The turbine unit measures 60 ft. in length, 15 ft. in height, and 19 ft. in width. The total weight, including the condenser, is 1,182,000 lb., the low and high-pressure turbine weighing 477,000 lb. There are 10 single high-pressure stages and two low-pressure stages. The turbine is rated at 45,000 h.p., and operates at 1,500 r.p.m. Steam is furnished through a 20-in. header at 250 lb. pressure, and superheated to 625°. Of the steam-admission valves, 18 in number, 14 are used up to full load, and admit steam to the upper half of the first stage, while the other four are used for overloads.

The condenser is of the two-pass surface type, and contains 11,000 tubes of 1 in. diameter each, constituting a cooling surface of 50,000 sq. ft. The cooling water in the condenser weighs 65 tons. 52,000 gallons of circulating water are passed through the condenser per minute, requiring for this purpose a 650-h.p. Curtis non-condensing turbine, which operates at 1,500 r.p.m., directly connected to a 48-in. double-suction centrifugal pump working against a head of 15 ft.

Institution and Lecture Notes.—Fuel Economy.—At Nottingham University College, last week, Prof. H. E. Armstrong gave a lecture on a national fuel and power policy, in the course of which he severely criticised the policy of the Nottingham Corporation, which was alleged to refuse to supply electric power to factories except on terms that applied to the ordinary small consumer, with the result that several important firms in the town were installing electric power plant of their own. He strongly advocated the establishment of a central Fuel and Power Board, which should promote the scientific use of coal, and dwelt on the importance of carbonising coal at a low temperature, so as to obtain a good smokeless fuel for domestic use, gas for power, and all the residuals. A resolution was unanimously adopted urging the immediate development of a national policy to govern the use of our fuel supplies.—*Nottingham Guardian.*

Leeds Association of Engineers.—The annual report for the past year states that the surplus revenue amounted to £101, and the assets were valued at £5,050. Satisfactory progress has been made during the year.

Inquiries. — Makers of the "Realm" lamps, and of "Holeby Tuxham" and "Houmoller Alpha" marine motors, are asked for.

Fatality.—Patrick Davis, a Dublin electrician, was fatally crushed at Amiens Street Railway Station (Great Northern of Ireland), on Saturday last.

Nitro-Energy.—In this period of stress and strain, the importance of the Sunday newspaper has advanced by leaps and bounds. Very few of us are content to wait from Saturday night till Monday morning for the latest news from the Front. Incidentally, therefore, the immense amount of printed matter which is now supplied in the leading Sunday papers has acquired a new importance. All the more is it to be regretted that such articles as the one which appeared in a Sunday contemporary recently, headed "Nitro-Energy," should be dangled before an anxious and unscientific public. The matter that caught our eye was one of the sub-headings, "Electricity at 1/50th the Cost."

Reading the article we find that an American mining engineer has come to England with an invention for using nitrogen as an energy-producer in place of coal, at a fraction of the cost; and he is generously offering it to the British Government. His estimate of the total nitrogen in the earth's atmosphere now available for use in the production of the new power is nearly 4,000 billion tons. Lest there should be any anxiety, however, that this enormous supply should eventually be completely used up, we are informed that, unlike all other fuels, which are destroyed, his method of using "nitro-power" converts the fuel back into its elemental state. Obviously, therefore, we have here a source of unlimited power which will last for ever and ever, without diminution, like the widow's cruse.

When we had fully taken this in, we were prepared to read further that this new energy could be used for every purpose for which coal and crude oil are now used, even to smelting.

This great invention is not only to come in as part of the reconstruction in that dim and happy future, after the war, but it is even to be made available for war purposes within the next three months. "Submarines large enough to mount 6-in. guns can be driven twice round the world by this energy without re-fuelling." The difficulties in connection with freight in shipping tons of mere fuel will, therefore, be entirely avoided. The energy melts away into the water, or the ether, or somewhere, without causing any bubbles to rise to the surface to betray the presence of the submarine. No batteries are needed, the space occupied by them being available for torpedoes. The speed claimed for the new submarine is the same as that of a destroyer of the present day.

No smoke stacks are required, and we are told, further, that half a ton of nitro-energy on a battleship or a cargo boat would do the work of 600 tons of coal and leave immense space for war material in the one and for commerce-carrying purposes in the other.

The inventor, we are told, is producing temperatures of 8,000° F., and yet the temperature outside the generators is the same as that of the surrounding atmosphere. The action is all automatic.

The inventor concludes by saying that he could, if he wished, form a company in the City to work the invention, but that is not his purpose. "It is an invention of such stupendous possibilities, that I want to place it in the hands of the nation."

Many times before we have had occasion to remonstrate with our non-technical contemporaries over articles, generally in connection with new inventions, upon which they should have sought expert opinion. In these days it is really deplorable to find that the power of the Press can be applied in our own particular field with such absolute ignorance of the first principles of science. Surely, with so many scientific men practically out of work, it would not be difficult for wealthy newspapers to get the advice of one or two such men before printing matter of this kind—fatuous drivel from start to finish.

A Siemens Centenary.—In honour of the centenary of the birthday of their ancestor, Werner von Siemens, the von Siemens family, says a telegram received by wireless from Berlin, have established a fund of £50,000 for the construction of houses for employés and workmen. The Siemens & Halske Co., Ltd., and the Siemens-Schuckert Works have each added £50,000.—*Times.*

The Tribunals and Diesel Men.—We read in the *East Anglian Times* that at the Felixstowe Tribunal, last week, the Electricity Supply Co. claimed conditional exemption for the following men, viz.:—An electrician and Diesel engine-driver in charge of a power house, married, aged 30, on the ground of certified occupation and national interest; the Tribunal gave the man temporary exemption to March 31st next. A fitter, turner, and Diesel engine-driver, married, aged 24, on the same grounds; the Tribunal decided not to assent to the application. An engineer and electrician, married, aged 37, on the same grounds; the Tribunal gave the man temporary exemption to January 31st next, no further application without leave of Tribunal. An engineer and electrician, married, age 36, on the same grounds; the Tribunal gave the man conditional exemption.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Chester House, Eccleston Place.—Lieut.-Col. C. B. Clay, V.D., Commanding.

From *Thursday, December 21st*, to *Thursday, December 28th*, inclusive.—Headquarters closed.

Friday, December 29th. — Technical for Platoon No. 10, at Regency Street. Squad and Platoon Drill, Platoon No. 9. Signalling Class. Recruits' Drill, 6.25 to 8.25.

(By order) MACLEOD YEARSLEY, *Adjutant.*

Industrial Research in Canada.—The Canadian Government has appointed an honorary advisory council on scientific and industrial research to advise a committee of the Cabinet on all matters relating to the extension and co-ordination of scientific and industrial research.

Self-Luminous Compound for Switches. — One of the large manufacturers of switches, sockets, and supplies is now preparing to bring out a line of electric light switches and sockets painted with a self-luminous compound which will render their position visible in the dark. A "radium" paint will be used, similar to that already employed on luminous-dial watches, compasses, &c. This paint is continuously self-luminous, and, it should be noted, is to be distinguished from the luminous paints and pull-chain balls which have been on the market for some years, which require exposure to strong light to make them luminous in the dark for a period of several hours.

The base, zinc sulphide, is the same for the new self-luminous paint as for the older phosphorescent paint which absorbs light and then gives it out again, shining with a greenish or bluish glow in the dark. The new paint, however, contains a small quantity of radium bromide, the alpha particles of which, continuously bombarding the crystals of the sulphide, render it luminous in the dark with a pale greenish glow of about the intensity of a rubbed phosphorus match. By increasing the quantity of radium compound included in the paint, the more brilliant can this phosphorescent glow be made. On aeroplane compasses used by the European armies, the luminous compound employed is of such intrinsic brilliancy that its glow can be seen even in contrast with twilight. Such a high mixture of radium compound, however, rapidly disintegrates the zinc sulphide, so that the life of the paint may be barely 12 months. In the intensity to be used on the new switches, which has been found most practical for average use on watch dials, &c., the figures are readily visible in a darkened room, and such paints have an assured luminous life of 10 to 15 years, if not longer.

It is proposed to tip the switch push buttons with this luminous compound, so that when entering a darkened room the user can quickly find the button, press it, and secure electric light.

In order that ordinary flush switches already installed may be made luminous, the electrical manufacturer referred to has devised the ingenious expedient of luminous-head screws which can be used to replace the present screws, giving visible points of luminosity by which the switch can be located in a darkened room.

The cost of making and applying the self-luminous paint is, at present market prices of materials, about $1 per sq. in. At this rate it is expected that the extra cost of equipping an ordinary electric light switch will be from 20 cents to 30 cents.—*Electrical World.*

The A.C. Arc used in Scrapping Plant.—When the Llewellyn Iron Co. took the contract of dismantling and scrapping three compound Corliss engines and the three 800-KW. direct connected generators in an old railroad power house in Los Angeles, it was discovered that in order to reduce the machinery into pieces small enough to handle, a great amount of cutting must be done on the job. It was impracticable to use the oxyacetylene flame for the reason that practically all of the cutting was on cast-iron. To drill and wedge the various pieces apart was a laborious job, and the following method was tried as an experiment.

Two 50-KW. transformers were set up in the engine-room and connected to a single-phase 2,200-volt, 50-cycle main, through fuse blocks and an oil switch, from the Southern California Edison Co.'s system. The primaries of the transformers were connected in series while the secondaries were connected in parallel so as to supply 52-volt service. Two 4/0 cables in parallel made up each secondary lead, one lead terminating at a movable holder which consisted of a hollow wooden rod about 5 ft. long, to the end of which was fastened a metal clamp for holding a carbon electrode 3 in. in diameter and about 12 in. long. The other lead was made fast to the casting that was to be cut.

In order to prevent abnormal surges on the line, a resistance of about 30 ohms was inserted in series with the primary. With 52 volts on the secondary it was impossible to maintain the arc, especially on heavy cutting, so the primary connections were changed to parallel, giving a transformer capacity of 100 KW. with the secondary voltage raised to 110.

With one man occupied continually with the cutting, the energy consumption for about one week's use was approximately 1,000 KW.-hours measured on the primary. With a light cut, such as the spokes of the fly-wheels, collector rings, foundation bolts, piston rods, and the like, the normal current in the primary was about 35 amps. with swings to 100 amps. On heavy cuts, such as armature spiders, bed plates, and wheel rims, the current consumption was around 60 amps. with swings as high as 150 amps., measured on the primary.

Since the apparatus used was very crude, the time necessary to make the cuts was longer than would be needed with a more refined equipment. To cut a 2-in. foundation bolt required from three to four minutes, depending on the ease with which it was possible to approach the work. A cast-iron ring of section 25 in. × 1½ in. was cut through in one hour's time. The carbon consumption was a practically negligible quantity, except for breakage due to the cumbersome holder. A 3-in. diameter carbon 24 in. long was sufficient for all the cutting that was done in 10 days. It is contemplated to install an equipment of this kind as a permanent arrangement, substituting a reactance in the primary in place of the resistance to limit the primary current to ten times the full load current of the transformers.—G. W. TEFFEAU, JNR., in the *Electrical World.*

Flood-lighting Policemen.—In St. Louis, U.S.A., the traffic-control policemen at busy crossings are being put "in the limelight" by means of 500-watt lamps in flood-lighting projectors, mounted high up on adjacent buildings, so that the constables can be plainly seen without dazzling them or the drivers of vehicles.

Fire.—The *Daily Telegraph* states that a disastrous fire occurred at Tonbridge, last Saturday, resulting in the complete destruction of the telegraphic and electrical stores of the South-Eastern and Chatham Railway.

Northampton Polytechnic Institute.—On Saturday afternoon last the annual prize distribution took place, the prizes and certificates being presented by Mrs. R. Mullineux Walmsley. The presentation was preceded by an organ recital, and after the ceremony the proceedings concluded with the Rumanian and British National Anthems.

Glasgow Electricians' Wages.—The arbiter in the dispute between the Electrical Contractors' Association of Scotland and the Electrical Trades Union in connection with an application by the latter for an advance of 2d. per hour for their members employed by firms in the Association in the Glasgow district has, after consideration of all the circumstances, awarded to the electricians and armature winders in the employment of the above firms an increase of ¾d. per hour, on the same terms as those on which this increase was granted to the men concerned in the Clyde district by the award of the Committee of Production on September 20th last, but with the difference that the increase in the present case shall begin on the first day following the issue of this award.—*Glasgow Herald.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Chesterfield Corporation has advanced the salary of Mr. E. P. AUSTIN, assistant borough electrical engineer, from £220 to £250 per annum.

Mr. W. M. GIRVAN, who has held various positions in the electrical department of the Belfast Corporation, has been appointed general electrical superintendent at the central generating station.

Mr. A. W. JOHNSON has been appointed charge shift engineer at the L.C.C. Greenwich generating station at a salary of £250 a year, rising by annual increments to £300.

General.—Mr. E. EASTWOOD, who for the past 11 years has had charge of the electrical repair shops of the London County Council tramways at their central repair depôt, Woolwich Road, has resigned his appointment with them, and has accepted the post of manager for the Electrical Repair Co., Martin's Yard, Endwell Road, Brockley, S.E., who are specialising in all types of armature and field coil winding and repairs.

The John Fritz medal was awarded in January, 1916, to Dr. ELIHU THOMSON, for "Achievements in Electrical Inventions, in Electrical Engineering, in Industrial Development, and in Scientific Research," and was to be presented to Dr. Thomson in Boston on December 8th.

Roll of Honour.—The *Staff War Bulletin* of the County of London Electric Supply Co., Ltd., and associated companies, including the South London Electric Supply Corporation, contains a Roll of Honour revised to date, and photographs of men holding commissions. Since the last issue 54 more men have joined the Services, making the total to date 408. Interesting extracts from letters from the Front are given.

The Serbian Military Medal, for services rendered in the field at Salonika, has been awarded to Sapper J. B. SULLIVAN, of the Signalling Section of the R.E., who was formerly in the engineer's department of the telephone office at Canterbury.

Rifleman J. ELKINGTON, Rifle Brigade, who has fallen in action, was prior to the war with the British Thomson-Houston Co., Ltd., at Rugby.

Company Sergeant-Major ALLAN CORFE, who has died of wounds, was a draughtsman with Messrs. Mirrlees, Bickerton and Day, Stockport.

Gunner WILLIAM WOLSTENHOLME, R.F.A., who has been invalided home from France, was employed by Messrs. Jones Bros., electricians, Blackpool.

Private HARRY BURNS, Manchester Regiment, reported missing, was employed by Messrs. W. T. Glover & Co., Ltd., Trafford Park.

Lance-Corporal BERNARD ABRAMS, Manchester Regiment, wounded and in hospital, was employed by Messrs. I. Frankenberg & Sons, Ltd., Salford.

Second-Lieutenant ROBERT CARR, R.E., assistant manager of the Ormskirk Gas & Electric Co., has been awarded the Military Cross.

Private R. TENNANT, Machine Gun Corps, aged 26, killed in action, was with Messrs. D. Rowan & Co., of Glasgow, as an electrician.

Captain P. T. FOYSTER, R.E., aged 28, who died of wounds on December 11th, was, according to the *Times*, assistant engineer to the British Engine & Boiler Insurance Co., at Manchester.

Corporal MARK BOGG, who has been awarded the Military Medal, was an employé at the Leeds Corporation electricity department. He has been wounded four times.

Private JOHN APPLEBY, North Staffs. Regiment, who enlisted whilst on the staff of the Hanley Electricity Works, is reported missing.

Sergeant W. E. RICKARD, R.A.M.C., a former employé of the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., has won the Military Medal.

Obituary.—MR. G. H. POWNALL.—Mr. G. H. Pownall, President of the Institute of Bankers, to whose address on banking and trade and industry we recently referred in the ELECTRICAL REVIEW, passed away last Saturday at the age of 67 years.

MR. EDWIN HODGSON.—The death is announced, at the age of 60 years, of Mr. Edwin Hodgson, who had for a long period carried on business as an electrical engineer at Northgate, Cleckheaton.

SEC.-LIEUT. JOHN SEAR GIBSON.—Sec.-Lieut. John Sear Gibson, attached to the Trench Mortar Battery, who has died of wounds received in action, aged 32, was an electrical engineer at Tunbridge Wells, and an A.M.I.E.E.

Will.—The late Sir JAMES SIVEWRIGHT left estate of the value of £98,784. The bequests include £10,000 to the Senatus of the University of Aberdeen, and £5,000 to the Committee of Milne's Institute, Fochabers.

NEW COMPANIES REGISTERED.

Midland Dynamo & Motor Repairs, Ltd. (145,468).—This company was registered on December 5th, with a capital of £3,000 in £1 shares, to carry on the business of electricians, electrical, mechanical, motor, telephone, heating, ventilating, and general engineers, bellsmiths, gas fitters, maintainers, and repairers of and dealers in all kinds of electrical apparatus, aeroplanes, airships, motor cycle and car fittings, alabaster, porcelain, china, and earthenware goods, petrol, benzol, and oils, varnish, and chemicals of all kinds, &c. The subscribers (with one share each) are: B. Gill, 49, Winchester Avenue, Leicester, electrical engineer; G. Ward, 420, Narborough Road, boot and shoe manufacturer. Private company. The first directors (to number not less than two or more than four) are: B. Gill and G. Ward. Solicitor: W. Harding, 14, New Street, Leicester. Secretary: P. Haynes, 8a, Pocklington Walk, Leicester. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Midland Electric Co. (Southport), Ltd. (145,444).—This company was registered on December 2nd, with a capital of £1,000 in £1 shares, to take over the business carried on at Southport (Lancs.) by T. E. K. Greenhalgh, as the Midland Electrical, Gas & Incandescent Co. The subscribers (with one share each) are: T. E. K. Greenhalgh, 99, Hawkshead Street, Southport, engineer; A. L. Clough, 85, Liverpool Road, Birkdale, accountant. Private company. The first directors (to number not less than two or more than five) are to be appointed by the subscribers. Qualification, £200. Remuneration as fixed by the company. Solicitor: J. P. Mitchell, Southport. Secretary: A. L. Clough. Registered office: 16a, Hill Street, Southport.

Reuter's (1916), Ltd. (145,516).—Registered December 11th by Bircham & Co., 50, Old Broad Street, E.C. Capital, £200,000 in £1 shares. Objects: To take over the telegraphic business heretofore carried on by Reuter's Telegram Co., Ltd., to carry on and extend the same, to obtain and supply wireless, telegraphic, telephonic, and other news and intelligence, to carry on business as advertisement contractors and agents, to construct, purchase, hire, or otherwise acquire and work wireless installations, telegraphs, and telephones, to undertake and facilitate the collection and remittance of money, securities, and other valuables, merchandise, and property in, to, and between any part or parts of the world, and either by wireless, telegraph, telephone, or otherwise to grant and issue letters of credit and circular notes, to receive deposits of money and securities, to open credits, and generally to utilise the means of intercommunication possessed by the company for the purpose of granting pecuniary, financial, and commercial facilities in and between any part or parts of the world, to advance money on, and deal with, bullion, specie, produce, and merchandise, and the documents of title relating thereto (particularly in connection with the dispatch or carriage thereof between different countries or places), to act as bankers, and carry on every description of English and foreign banking business, to undertake mercantile, financial, insurance, and other agencies, especially in foreign and distant places, and on instructions given or transmitted by wireless, telegraph, telephone, mail, or similar means of communication, &c. The signatories (with one share each) are: Lord Glenconner, 34, Queen Anne's Gate, S.W.; Sir Leander Starr Jameson, Bart., 2, Great Cumberland Place, W. Private company. The first directors (to number not less than three or more than eight) are the Hon. Mark F. Napier (chairman), the Hon. Edmund Parker, George Grinnell-Milne, Gerald W. Williams, Roderick Jones, and John Buchan. Remuneration (excluding salary of any managing director), £2,300 per annum, or such larger sum as the company may determine, divided between them. Solicitors: Bircham & Co. Registered office: 24, Old Jewry, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electro Mechanical Brake Co., Ltd. (98,276).—Capital, £30,000 in £1 shares (2,500 pref.). Return dated November 6th, 1916. 1,500 pref. and 22,500 ord. shares taken up; £1 per share called up on 1,500 pref. and 16,465 ord.; £17,965 paid; £6,035 considered as paid on 6,035 ord. Mortgages and charges: £7,500.

Cape Electric Tramways, Ltd. (54,636).—Capital, £500,000 in £1 shares. Return dated November 29th, 1916. 491,322 shares taken up; £91,222 paid; £400,000 considered as paid. Mortgages and charges: £364,700.

Landaulet Co., Ltd. (72,890) (formerly known as Electric Landaulet Co., Ltd.).—Capital, £50,000 in £10 shares. Return dated June 28th, 1916. 3,928 shares taken up; £39,280 paid. Mortgages and charges: £6,000.

Frederick Braby & Co., Ltd. (2,537c).—Capital, £400,000 in 37,500 ord. and 2,500 pref. shares of £10 each. Return dated August 3rd, 1916. 27,500 ord. and 2,500 pref. shares taken up; £10 per share called up on 24,250 ord. and 2,500 pref., and £6 per share on 3,250 ord; £287,020 paid, including £20 on five forfeited shares; £13,000 (£4 per share) considered as paid on 3,250 ord. Mortgages and charges: £55,000.

Electrical Installations, Ltd.—A memorandum of satisfaction to the extent of £300 on November 30th, 1916, of debs. dated December 5th, 1906, securing £2,000, has been filed.

Reid Bros., Engineers, Ltd.—Particulars of £7,000 debs., created November 28th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Veritys, Ltd.—A memorandum of satisfaction in full on September 12th, 1916, of mortgage dated April 29th, 1913, securing £800, has been filed.

Llanelly and District Electric Lighting & Traction Co., Ltd.—Second supplemental trust deed dated November 30th, 1916 (supplemental to trust deeds dated August 3rd, 1911, and November 11th, 1912), securing £45,000 deb. stock ranking *pari passu* with £75,000 like stock issued under principal and first supplemental deeds, charged on lighting and tramway undertakings, leasehold power station, and car sheds, and company's other assets, including uncalled capital. Trustees: Century Insurance Co., Ltd., 18, Charlotte Square, Edinburgh.

Traction Development, Ltd.—Mortgage debenture dated November 10th, 1916, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. L. Davis, Leadenhall Street, E.C.

Electrical Contracts & Maintenance Co., Ltd.—Particulars of £1,000 debentures, created December 5th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

W. H. Allen, Son & Co., Ltd.—Mortgage dated November 21st, 1916, to secure £103,980, charged on certain lands and premises in Bedford, Biddenham, Liverpool, and Westminster, life assurance policy, and company's undertaking and other assets present and future, including the benefit of a contract subject to prior charge.

Dixon & Corbitt and R. S. Newall & Co., Ltd.—Deed dated November 22nd, 1916 (supplemental to trust deed dated November 1st, 1904, securing £35,000 debs.), extending term and securing an increased rate of interest on the said debs., charged on certain lands, hereditaments, and premises and company's undertaking and property, present and future, except uncalled capital. Trustee: T. Bowden, Newcastle-on-Tyne.

Venner Time Switches, Ltd.—A memorandum of satisfaction to the further extent of £500 on October 19th, 1916, of debs. dated July 10th, 1911, securing £5,000, has been filed. (Amount outstanding, £2,450.)

Oriental Telephone & Electric Co., Ltd.—A memorandum of satisfaction to the extent of £2,049 on December 6th, 1916, of deb. stock covered by trust deed dated June 28th, 1905, and supplemental deed of acknowledgement dated June 12th, 1907, securing £200,000, has been filed.

CITY NOTES.

Northampton Electric Light and Power Co., Ltd.

An extraordinary general meeting was held last week to consider the proposal to increase the capital by the creation of 50,000 additional "B" shares of £1 each, which would bring the capital to £200,000. Ald. F. H. Thornton, J.P., presided, and said that the authorised capital was £150,000. Up to October, 1915, they had issued £110,000, and in November, 1915, the business had increased so much that they were obliged to call for £40,000 more to make the great extensions necessary for the developments of their trade. That amount was practically subscribed, and almost all of it had been spent in purchasing a site of 10 acres near Nunn Mills, and in making extensions which were necessary to meet the very important requirements of the boot trade during the present winter. In the present works they had used part of the money in the erection of a new set of 500 kw., and they had also laid mains extensively in the outlying parts of the town, the object being the supply of high-tension current at 6,600 volts to manufacturers. By that means they had been able to supply current economically. There was no room for any more plant at the present works, and they were now proceeding with their extensions on the site they had bought near the river. They intended to erect a generating station where all the current would be generated at high voltage, and the present works would become a transforming station. The issue of new capital had the sanction of the Treasury and the support of the Ministry of Munitions. From the point of view of the company, it was not a good time to make an issue, because money was dear. He did not suppose that at any other time it would have been necessary to issue shares, as the directors proposed to do, at par, because before the war their shares stood at 25s. 6d., but with the competition of Exchequer Bonds and War Loans generally, it was hopeless to try to get the money any cheaper. The directors estimated that they would save 6,000 tons of coal a year at their present works, and taking that at 10s. a ton they would have £3,000 a year, which was 6 per cent. on £50,000. In the new works they proposed to erect a 3,000-kw. plant, far larger than anything they had at present. The resolution was carried unanimously.

Melbourne Electric Supply Co., Ltd.

In their report for the year ended August 31st, 1916, the directors state that to provide for future expansion, it is proposed to increase the capital by £750,000, divided into 50,000 preference shares of £5 each, and 500,000 ordinary shares of £1 each, the latter to be converted, when fully paid, into consolidated ordinary stock ranking equally with the existing stock. The consents of the existing preference and ordinary shareholders in separate meetings being necessary to the creation of the new preference shares, such meetings were held yesterday following the annual meeting. A resolution was also submitted for increasing the borrowing powers by £250,000. During the year, £144,405 has been expended on additional land, buildings, plant, mains, &c., and the capital account now stands as follows:—

	Expenditure to Aug., 1915.	Expenditure during the year.	Total written off at Aug., 1916.	Balance of expenditure at Aug., 1916.
Melbourne	£954,227	£137,561	£14,680	£1,077,108
Geelong .. .. (including trams)	175,861	6,844	3,775	178,930
	£1,130,088	£144,405	£18,455	£1,256,038

The area of the suburban districts in Melbourne covered by the company's statutory powers is approximately 74 square miles, with a population of 366,000, and a supply is now available in 566 miles of streets, being an increase of 40 miles during the year; 4,522 new consumers were connected to the mains during the year, bringing up the total number connected to 27,713, being an increase of 20 per cent. as compared with the preceding year. The power supply has increased by 15 per cent., the electric motors now connected being equivalent to 20,106 h.p.; the total connections, including lamps, motors, heating, and other apparatus, have increased by 22 per cent., the total units sold by 36 per cent., and the gross revenue by 24 per cent.

The profit and loss account shows that the gross profit during the year amounted to £142,315, as compared with £117,677 for the preceding year, an increase of 21 per cent., which compares with an increase of 13 per cent. in the previous year. After payment of debenture interest, and management and general expenses at the London head office, and after making the following allocations, viz., to first debenture stock sinking fund £2,500, to consolidated debenture stock sinking fund £2,900, to income certificate service fund £1,800, to general reserve (raising the latter to £90,000) £20,000, to reserve for income-tax and excess profits duty £15,000, there remains a credit balance of £72,476. The dividends having been paid on the 7 per cent. preference shares, 10 per cent. for the year is paid on the consolidated ordinary stock, and there remains to be carried forward £21,366. To this is added £40,778 brought forward from last year, making a total credit balance of £62,144 to be carried forward, subject to any further demands in respect of excess profits duty. The following tables show the progress of the Melbourne and Geelong undertakings:—

Date.	Number of consumers.	Lighting in kw.	Motors in rated h.p.	Total connections in kw.	Total units sold.	Gross profit.
Melbourne—						
Aug., 1914	19,066	16,316	12,444	28,759	13,963,300	£93,202
Aug., 1915	23,191	19,932	17,609	37,541	17,486,300	£107,515
Aug., 1916	27,713	23,901	20,106	44,007	23,902,084	£131,673
Geelong— (including trams)						
Aug., 1914	1,839	2,050	2,085	4,136	1,275,280	£11,137
Aug., 1915	2,290	2,306	2,155	4,461	1,270,516	£10,162
Aug., 1916	2,573	2,468	2,314	4,782	1,519,944	£11,641

The business continues to be well maintained, notwithstanding the adverse influence of the war. There is an increasing demand for light and power from all classes of the company's consumers, including numerous firms in Melbourne and Geelong engaged in the manufacture of war munitions and requisites. The directors deem it advisable to make such alterations in the articles of association as will enable them to capitalise any part of the company's undivided profits and distribute same to the consolidated ordinary stockholders by way of dividend or bonus.

British Columbia Electric Railway Co., Ltd.

The directors in their report for the year ended June, 1916, state that after making provision for renewals maintenance £102,237, for income-tax £10,000, and for addition to capital amortisation fund £2,656, the net revenue amounts to £134,964, plus £6,667 brought forward and £70,000 transferred from the reserve fund, making £211,631. After deducting interest on debentures and debenture stock for the year, £132,771, and dividends already paid on 5 per cent. cum. perpt. preference stock for the year £72,000, £6,860 remains to be carried forward. It will be observed that in order to pay the above dividend the reserve fund has had to be drawn upon. The most determined efforts have again been made by the board and management to curtail expenditure in every direction. Operating and all other expenses have been rigidly controlled. The capital expenditure of the railway and subsidiary companies during the year amounts to $134,900, compared with $875,558 in the previous year. The general manager reports that the property of the company has been well maintained, and none of the economies effected have in any way impaired the efficiency, safety or general upkeep of the company's plant. The reduction in the population, the reduced spending capacity of the citizens, the continuance of the unfair competition of Jitney cars, together with the greatly increased cost of all supplies, are responsible for the decrease in the company's revenue. About 35,000 soldiers have left British Columbia for overseas service, of whom probably 25,000 have left the territory served by the company, and a

further large number of people more or less directly and indirectly dependent on them have also left. It can safely be estimated that, as compared with the year 1914, the population served by the company has decreased by 30 per cent. The railway business also continues to suffer severely from the competition of Jitney cars. Since January 1st this competition has been less acute than in the previous year, but it is estimated that these cars are still depriving the company of earnings amounting to approximately $350,000 a year. The various public services furnished by the company, including the railway service, have been fully and efficiently maintained, but with no improvement in the Jitney situation in prospect, the necessity of curtailing the car services has become urgent. The earnings from freight show an encouraging increase during the year, and this class of traffic promises to become an increasingly profitable part of the company's business. The company's financial position remain satisfactory. In spite of the present adverse situation there are indications of an improvement in commercial and industrial conditions in British Columbia, and with these the company's prosperity is closely bound up. The net earnings for the first four months of the current year show an encouraging increase of over £30,000, and the directors are not without hope that the profits of the current year will be sufficient to cover the debenture interest, and also the dividend on the 5 per cent. cum. pref. stock, without further trespassing on the reserve fund. The directors think that the company's financial position justifies the payment of the dividend on this stock for the current year, and a resolution will be submitted to the stockholders approving of this payment being made, and authorising the directors to draw upon the reserve fund, if necessary, for that purpose. The directors are unable to hold out any hope of the payment of a dividend on the pref. ord. or def. ord. stocks for the current year. Mr. R. H. Sperling, having been granted a commission in the Army, has retired from the board, to the great regret of his colleagues. Mr. Sperling has accepted the position of adviser to the board. Sir W. M. Aitken, Bart., M.P., and Mr. John Davidson have accepted seats on the board. A resolution will be submitted to the stockholders to increase the number of directors to nine, and, if approved, Sir William Mackenzie, who, on the invitation of the directors, has expressed his willingness to accept a seat on the board, will be elected. Sir William Mackenzie is president of the Toronto Railway Co., the Toronto Power Co., the Winnipeg Electric Railway Co., and other large public utility enterprises in Canada, and the directors are desirous of securing for the company the advantage of his wide experience.

Annual meeting: December 22nd.

Tata Hydro-Electric Power Scheme.

From the last issue to hand of the *Indian Textile Journal* (September), we learn that an extraordinary general meeting of the Tata Hydro-Electric Power Supply Co., Ltd., was held in Bombay in August, Sir Dorabji J. Tata presiding, at which was confirmed an agreement entered into by the directors of the company with Sir D. J. Tata, Sir Sassoon David, the Hon. Mr. L. Samaldas, and Mr. N. M. Goculdas, whereby it was agreed, subject to the confirmation of the shareholders of the company, that the interest of the company in the concession granted by the Government of Bombay for the development of the Andhra Valley in the Maval Taluka of the Poona district to the purposes of a hydro-electric scheme, shall be transferred to a new company to be formed by Sir D. J. Tata, Sir Sassoon David, Mr. L. Samaldas, and Mr. N. M. Goculdas. The chairman said that a statement explanatory of the reasons for the proposed transfer of the concession obtained by the company from the Government to develop a hydro-electric power project by the storage of water power in the Andhra Valley to a syndicate had already been supplied to the shareholders.

The circular to shareholders stated: "In October, 1915, an application was made to Government for a concession in respect of the Andhra Valley, and Government has very recently replied intimating the entertainment of such application. On further careful consideration, however, your directors came to the conclusion that it would not be practicable for the company to undertake this scheme, at all events in the near future, and a syndicate was then formed with a view to taking over the scheme from the company and forming a new company to work it. In the month of January last, when your directors came to the conclusion, and the syndicate was formed, the company had expended rupees one lakh or thereabouts upon investigations in connection with the Andhra Valley project, and was confronted with the necessity for payment of heavy fees for surveys, necessary works, and plant, &c., and it was then arranged that the syndicate should take up and continue the company's investigations and should defray all further expenditure in connection therewith; and the company's expenditure has stopped short at one lakh, which will come back to the company if the present agreement is confirmed. The Tata Hydro-Electric Power Supply Co., Ltd., was formed in November, 1910, as an undertaking for the supply in Bombay of 30,000 electrical H.P., and it was then estimated that a capital of Rs. 175 lakhs would be required, but subsequently the electric plant has been extended to 40,000 electrical H.P., and the hydraulic works, which are as yet incomplete, have been extended to a capacity of upwards of 60,000 electrical H.P. For the company's undertaking, which at its present contemplated state of development is for the supply of 40,000 H.P. in Bombay, a capital of rupees 262 lakhs (including debentures) has been raised, but further capital to the extent of approximately rupees 80 lakhs is required to complete the company's present undertaking, both to cover excess expenditure over the original estimates and to provide some further items not included in the original estimates; for instance, the acquisition of a strip of land beneath the transmission line for its full length from the power house to Khapoli to the receiving station in Bombay. The development of the Andhra Valley project is estimated to require a capital of rupees 200 lakhs, and if it were to be embarked upon by the company, the company would have to raise new capital to the extent of rupees 280 lakhs. One obvious objection to the Andhra Valley project being undertaken with capital raised by the company in extension of its present undertaking is the fact that rupees 85 lakhs in the capital of the company is represented by first mortgage debentures, and no further debentures ranking equally therewith can be issued. If the company undertakes the Andhra Valley project, the whole of the property acquired in connection therewith will merely go to increase the security of the holders of the debentures referred to, and the entire capital required for the development of the Andhra Valley project will have to be provided in shares, as it will not be feasible to place second debentures. This will necessarily render it difficult to finance the Andhra Valley scheme as an extension of the company's undertaking. Your directors, moreover, are advised upon technical grounds that it is important to the company, especially if supply is to be given to railways and tramways, that there should be two independent installations, interconnected as is now proposed, so that one may assist the other in emergencies in the maintenance of continuity of supply. Your directors, as stated above, do not consider that it is practicable for the company to undertake the Andhra Valley project in the near future, or, in fact, for some years, and, apart from any other reason, the indefinite postponement of an alternative supply is, in your directors' opinion, calculated to be prejudicial to the interests of the company. It must, moreover, be borne in mind that the concession granted to the company in respect of the Andhra Valley scheme will not be allowed to lie idle indefinitely, and that failure to take advantage of the concession may probably lead to its being withdrawn, and must of necessity open the door to other prospectors and to possible competition, which will not exist under the terms proposed to be entered into between the company and the intended new company."

The agreement, now confirmed, provides, among other things, the following consideration to be paid and satisfied to the company for the transfer of the concession:—

The new company shall pay to the company annually from the date of the registration of the new company the sum of Rs. 50,000, and as and when the new company shall earn profits divisible or capable of being divided amongst its shareholders by way of dividends the new company shall pay to the company annually either the said sum of Rs. 50,000 or a sum equivalent to 15 per cent. upon the remainder of its profits, whichever shall be the larger, the intention being that the company shall be entitled to receive from the new company the sum of Rs. 50,000 as a minimum annual payment. The remainder of the profits of the new company for the purposes of the before-mentioned periodical payment shall be arrived at after making all proper allowances and deductions, from the annual gross earnings for interest on debentures (if any), loans, and deposits, and for working expenses chargeable against profits, including agents' commission, and deducting a sum sufficient to pay a dividend at the rate of 7 per cent. upon the issued capital for the time being of the company paid up or credited as paid up, and such amount (if any) as may be required to satisfy any arrears of the cumulative dividend on the preference shares of the new company for the time being unpaid, and deducting a further sum for depreciation equivalent to 2 per cent. upon the capital expenditure of the company for the time being upon all buildings, machinery, plant, and other property of the company in respect of which deduction for depreciation would ordinarily be made in the case of undertakings of a similar nature. The new company shall enter into an agreement with the company defining so far as may be practicable the sphere and scope of the operations of each company where such operations are likely to clash, and for the purpose of promoting co-operation between the two companies and preventing competition, and of preserving and protecting the interests of the two companies.

Your directors consider that these terms are very liberal, and, although they firmly believe in the economic value of the Andhra Valley project, yet it is to be remembered that that scheme is not an established undertaking, and your directors consider that the present company will be well advised to obtain a definite and concrete consideration for its present undeveloped interest in the scheme.

German Electrical Companies.

The Helios Elektrizitats Gesellschaft, of Cologne, which has been in course of liquidation for some years past, has closed the year 1915-16 with an unchanged debit balance of £419,000. The securities in portfolio remain of the value of £69,000.

The Rheinische Schuckert Ges. fur Elektrische Industrie, of Mannheim, reports net profits of £45,500 for 1915-16, as compared with £45,000 in the previous year. It is intended to distribute 5 per cent. on the share capital of £550,000, being the same rate as in 1914-15.

The accounts of the *Suddeutsche Telefon Apparate, Kabel und Drahtwerke, A.G., of Nuremberg*, for the year 1915-16 show gross profits amounting to £43,000, as compared with £46,000 in the previous year, on an ordinary share capital of £50,000. The net profits are £11,000 and £14,000 in the two years respectively, the method of disposing of which has not been disclosed for either year.

The liquidators of the *Moore Licht A.G.* state that several patents were disposed of during 1915-16, whilst the remaining patents are to be allowed to lapse. The non-realisable debts owing in France, England, and Russia, together with

claims forming the subject of legal proceedings, had been sold by auction. So far the return to the shareholders had amounted to 86½ per cent., and the liquidators hoped that a total of 100 per cent. would be eventually distributed.

The report of the *Bayerische Stickstoffwerke A.G., of Munich*, states that the demand for nitrogen of lime (cyanamide) continued to expand in 1915-16, and that this material had not only proved to be a valuable substitute for the nitrogenous fertilisers hitherto used, but results had also been obtained from it which would ensure to the product a constant market in open competition with other artificial nitrogenous fertilisers. The maximum price in 1915-16 had been fixed at 1s. 5½d. and then at 1s. 5d. per kilogramme of nitrogen in nitrogen of lime, free at consumers' stations, including bags. The maximum price only slightly exceeded the price in peace times, and was essentially cheaper than the price of other nitrogenous fertilisers. It had been possible to bring into full operation the extensions of the plant near Trostberg, and it was proposed now to begin the works for the utilisation of the power available at Tacherting-Margarethenberg, on the Alz. The net profits are reported at £73,000, as compared with £57,000, and a dividend at the rate of 14 per cent. has been declared, this contrasting with 12 per cent. in 1914-15.

Companies Struck Off the Register.—The following companies have been struck off the register, and are accordingly dissolved :—

Auto-Electrics, Ltd.
Auto-Flash Sign Co., Ltd.
Cable Construction Syndicate, Ltd.
F.B. Two-Stroke Engine Co., Ltd.
Flash Controller Co., Ltd.
Grindell-Matthews Radiophone Syndicate, Ltd.
Holmes Motor Speed Controller, Ltd.
Improved Wheel & Axle Adjustment Co., Ltd.
International Power & Light Trust, Ltd.
Lester Engineering Co., Ltd.
Llanidloes Electric Lighting Co., Ltd.
Pioneer Pump Patents (1913), Ltd.
Radium Treatments, Ltd.
Sandors Motive Power Syndicate, Ltd.
Scientific Researches Co., Ltd.
Turbiro Engine & Pump Co., Ltd.
Wireless Telephones, Ltd.

Buenos Aires Lacroze Tramways Co., Ltd.—The gross receipts for the past year were $5,883,262, a decrease of $217,389. The working expenses were $3,895,787, an increase of $135,005. The causes of these results are: the large number of people leaving the country owing to the war, and the stoppage of works in general causing unemployment, and so decreasing traffic, notwithstanding the liberality of the services which the company had continued to give. The working balance is $1,987,475, and after deducting debenture interest, amortisation of municipal concessions, paving accounts, &c., the balance is $644,519, plus $83,638 brought forward. $32,225 is put to reserve, $32,225 goes to directors, $3,222 (¼ per cent.) goes to the syndicate, and $625,000 to the shareholders, leaving $35,483 to be carried forward.

Buenos Aires City & Suburban Tramways, Ltd.—The directors report that the construction of the line between Olivos and San Isidro has been completed, but the level crossing over the Central Argentine Railway Co. at Olivos has not yet been built, and the line beyond that point has not been opened. Relations with the municipal and provincial authorities continue to be satisfactory.—*Financier.*

Blackpool, St. Annes, & Lytham Tramways Co., Ltd.—The traffic receipts for the past year were £46,893. The amount paid to the Corporation of Blackpool was £10,123. Traffic expenses amounted to £7,848, general expenses £3,742, general repairs and maintenance £7,535, power expenses £5,046, and rent of leased lines £2,294, the balance to profit and loss account being £11,714. The directors recommend the trustees for the debenture holders to distribute the full year's interest of 5 per cent. upon the debenture stock, this being on account of arrears due to date.

Automatic Telephone Manufacturing Co., Ltd.—The preference share and transfer books are closed from 18th to 25th inst., for the purpose of preparing the dividend warrants on the 6 per cent. preference shares for the half-year.

Adelaide Electric Supply Co., Ltd.—A general meeting of this company was held on December 18th to approve the payment of the usual dividend. The annual meeting will not be held until the receipt of the duplicate accounts from Adelaide.

Ferranti, Ltd.—The annual meeting was held on Tuesday, at Basildon House, E.C. The proceedings were not open to the Press.

Cordoba Light, Power & Traction Co.—The accounts for the year ended September 30th, after payment of debenture interest, show a loss of £230, which reduces the credit balance of £26,581 brought forward to £26,351. This amount is to be carried forward.

Cuban Telephone Co.—Dividend, $1½ per share on the preferred and common shares.

Eastern Telegraph Co., Ltd.—Third quarterly dividend, 1½ per cent. on the ordinary stock, free of tax.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Interim dividend for September quarter, 3s. per share, free of tax.

Tucuman Tramways, Light & Power Co.—For the year ended June, 1916, the net profit was £7,305, reducing the debit balance to £35,210.

STOCKS AND SHARES.

TUESDAY EVENING.

With the close approach of the Christmas holidays, it was scarcely to be anticipated that the Stock Exchange would be in a commercial frame of mind. As a matter of fact, the unexpected has happened this week; and in consequence of the effective reply made by the French at Verdun to the German peace proposals, coupled with the conviction that the proposals themselves were actuated by growing weakness on the part of the Central Powers, prices have been good in the markets and business rather more active.

The outstanding feature is the strength of Home Railway stocks. In their market, prices have risen from one to three points during the past few days, the reason being that the Government have admitted the taking over of the railways to have proved a remunerative bargain for themselves. This was said partly to justify the acquisition of shipping and coal interests; and the statement was sufficient to revive the jaded spirits of holders of Home Railway stocks and to make them feel that, after all, their investments might hold something pleasant for them, notwithstanding all the rebuffs and checks to which they have been subjected by Government restrictions and Labour troubles.

The British Columbia Electric Railway Co. has issued its eagerly-awaited report, and, judging from the severe slide that has taken place in the company's stocks during the last three weeks, it would seem very much that somebody had advance knowledge of what the figures were going to show and was trying to get out before the report did. The company is going to pay the 5 per cent. dividend on its preference stock, but in order to do this a sum equivalent to that which is required for this service is to be withdrawn from the reserve, and careful analysis of the report will show that the company has earned comparatively little more than its debenture interest.

Such a result justifies the falls which have been taking place during the past month; but that the weakness should have been apparent so long before the actual accounts were published is at least a strange coincidence. The company is evidently suffering badly from competition; and while it is hoped that the present tide of its fortunes will prove to be the lowest ebb, it is obvious that the management have still anxious times ahead of them.

Brazilian Traction common shares have recovered to 46¼, moving in sympathy, to a great extent, with the shares in the American-Canadian companies concerned with munition-making. These have been undergoing sharp fluctuations during the past few days. The peace hopes which make for strength in Consols and domestic securities naturally have an opposite effect upon those of American munitioneers. Canadian Generals gave way, but recovered a trifle. Other lighting and power issues are scarcely mentioned.

The dangers which beset London in consequence of its lighting restrictions were thrown into deeper gloom on Saturday night by a thick fog which involved metropolis and suburbs. 'Buses and trams had to stop running, means of communication were reduced in numbers of cases to shanks's pony, and innumerable were the tales of minor accidents to people who lost their way in the darkness.

It might well be thought that on such an occasion the authorities responsible for the lighting orders would have had the audacity to brave the Zepps and turn up the light, if only for an hour or two, in order that Londoners might see their way to get home—especially when it is considered that, had danger threatened, all lights could have been extinguished or dimmed in so short a space of time. But perhaps the powers that be were not out in the fog and paid no heed to the obvious risk to life and limb.

Meanwhile, shares in the lighting companies continue to droop, further declines taking place in the shares of the city and the county companies; and the market as a whole is as dull as the weather. Westminsters are 5s. down at 5¾, and St. James' lost a similar fraction at 6. The various peace hopes circulating round the Stock Exchange have not yet afforded the electricity supply department any support. The Adelaide Electric Co. is paying the usual dividend and bonus, making 12 per cent. in all, on its ordinary shares, although the chairman explained at the meeting the other day that the audited accounts from Adelaide for the past financial year had been lost, owing to the sinking of the *Arabia*.

The Melbourne Electric Supply Co. reports a profit for the year ended August 31st last of £142,000, being an increase of £25,000, as compared with the preceding year. The directors recommend a final dividend of 5 per cent., free of tax, making 10 per cent. for the year. The meeting is to be held this week, and the directors are seeking powers to alter the articles of association, with a view to enabling them to capi-

talise any part of the undivided profits and to distribute the same to ordinary stockholders by way of dividend or bonus. The price of the stock is about 156.

One of the most satisfactory reports that have been issued for some time past is that of the India-Rubber & Gutta-Percha Co. The profits have leapt up from £80,000 in 1914-15 to £133,800 for the year just ended. The directors are retaining the ordinary dividend of 10 per cent., £50,000 being used to buttress the reserve fund, while the carry-forward of £40,000 is twice as much as it was a year ago. The price of the shares has risen 12s. 6d. to 13¾.

Henleys are ¼ better at 16½, but other manufacturing shares incline to be slightly easier. British Westinghouse preference, Babcock & Wilcox, and Castner-Kellners are all a trifle down. The Dick, Kerr Co. has made an offer to the United Electric Car Co. for the purchase of the shares in the latter company. The price of Dick, Kerr ordinary is 15s. 3d., and the 6 per cent. preference stand at 17s.

The telegraph market is disposed to be a little heavy, although the Eastern group stands out as exceptional to the prevailing tendency. Business has sprung up again in Marconis, the parent shares rising to 2⅞ buyers, while American Marconis at 17s. 3d. are 3s. 6d. higher than they were a fortnight ago. United River Plate Telephones gave way to 6 11/16.

The rubber share market is quiet, unperturbed by the gyrations in the price of the raw material. After being nearly 3s. 6d., rubber went back to 2s. 9d., from which it recovered to 2s. 11d. per lb. Good reports and dividends from the leading companies are the principal factors which have helped to keep the market firm. Armament and explosive shares are mostly lower on the week, for obvious reasons.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Dec. 19, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6¾	—	£7 11 0
Charing Cross Ordinary	5	5	3⅞	—	7 8 2
do. do. do. 4½ Pref..	4½	4½	3 7/8	—	6 11 0
Chelsea	5	4	3	—	6 13 4
City of London	9	8	11⅜	— ¼	7 0 8
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10½	— ¼	6 18 3
do. 6 per cent. Pref.	6	6	9⅞	— ¼	6 1 6
Kensington Ordinary	9	7	6⅜	—	6 4 5
London Electric	4	3	1⅝	—	6 10 5
do. do. 6 per cent. Pref.	6	6	4 7/8	—	6 15 4
Metropolitan	3½	3	2½	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3⅝	—	7 4 0
St. James' and Pall Mall	10	8	6	— ¼	6 13 4
South London	5	5	3⅝	—	7 5 6
South Metropolitan Pref.	7	7	1 3/4	—	6 7 9
Westminster Ordinary	9	7 *	5⅞	— ½	6 1 9
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	95¾	—	6 5 8
do. Def.	80/-	88/6	2⅞	+ ½	7 10 0
Chile Telephone	8	8	7⅝	—	5 12 8
Cuba Sub. Ord.	5	5	3½	—	6 8 6
Eastern Extension	7	8	1⅝	+ ½	*5 14 4
Eastern Tel. Ord.	7	8	140½	+1	*5 14 0
Globe Tel. and T. Ord.	6	7	12½xd	+2/-	*5 13 0
do. Pref.	6	6	10xd	—	5 18 5
Great Northern Tel.	22	22	37	— ½	5 19 0
Indo-European	13	13	49½	—1⅜	5 11 4
Marconi	10	10	2⅞	+ ⅛	3 19 5
New York Tel. 4½	4½	4½	1 1	—	4 9 0
Oriental Telephone Ord.	10	10	2.5	—	4 6 6
United R. Plate Tel.	8	8	6 7/8	— 1/32	*5 19 8
West India and Pan.	1	6d.	1	—	2 4 0
Western Telegraph	7	8	15¼xd	—	*5 15 4
Home Rails.					
Central London, Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	1½	1	25½	+2½	3 19 2
do. District	Nil	Nil	16½	+1	Nil
Underground Electric Ordinary	Nil	Nil	2⅜	+ 1/8	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	6	6	92½	+1½	*6 9 10
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅛	—	6 1 6
Anglo-Arg. Trams, First Pref.	8½	8½	8xd	—	9 3 4
do. 2nd Pref.	6½	6½	2⅞	—	—
do. 5 Deb.	5	5	65½xd	—	7 12 8
Brazil Tractions	4	4	46½	+ ½	8 12 0
Bombay Electric Pref.	6	6	10½	—	5 17 8
British Columbia Elec. Rly. Pfce.	5	5	62½	—4½	8 0 0
do. do. Preferred	—	Nil	42½	—1⅝	Nil
do. do. Deferred	—	Nil	40⅝	—3	Nil
do. do. Deb.	4½	4½	82	—	5 17 4
Mexico Trams 5 per cent. Bonds	—	Nil	32½	—	Nil
do. 6 per cent. Bonds	—	Nil	27½	—	Nil
Mexican Light Common	Nil	Nil	12½	—	Nil
do. Pref.	Nil	Nil	17½	—	Nil
do. 1st Bonds	Nil	Nil	83½	—	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	2 1/2	— ¼	5 6 9
British Aluminium Ord.	6	7	35/-	—	5 6 8
British Insulated Ord.	15	17½	11⅝	—	7 5 10
British Westinghouse Pref.	7½	7½	2⅝	— 1/16	5 8 4
Callenders	15	20	13	—	7 13 10
do. 5 Pref.	5	5	4¼	—	5 17 8
Castner-Kellner	20	22	8 7/16xd	— ¼	6 13 4
Edison & Swan, £3 paid	Nil	—	1/16	—	Nil
do. do. fully paid	Nil	—	1/8	—	Nil
do. do. 4 per cent. Deb.	5	5	62½	—	8 0 0
Electric Construction	6	7½	1 1/16	—	7 1 2
Gen. Elec. Pref.	5	5	10	—	6 0 0
do. Ord.	10	10	18½	—	7 5 6
Henley	20	25	16½	+ ½	7 13 10
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	13⅜	+ ⅜	*7 6 6
Telegraph Con.	20	20	88	—	*6 5 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/7	1d. dec.
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	"	£54	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£34	..
a Copper Sulphate	"	£63	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	143/-	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	"	£19	£1 inc.
a " Lump	"	£16	..
a Soda, Chlorate	per lb.	1/-	..
a " Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/10 to 1/10½	½d. dec.
g " Bars (best selected)	per ton	£125	£4 dec.
g " Sheet	"	£135	£4 dec.
g " Rod	"	£135	£4 dec.
d " (Electrolytic) Bars	"	£150	£10 dec.
d " " Sheets	"	£178	£10 dec.
d " " Rods	"	£169	£10 dec.
d " " H.C. Wire	per lb.	1/8	1d. dec.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/3	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/3½	1½d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£36	..
g Lead, English Pig	"	£34 5	..
g Mercury	per bot.	£18 15	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e " " medium	"	3/6 to 6/-	..
e " " large	"	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/11	½d. dec.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	2/11	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
F. Wiggins & Sons.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons
r W. P. Dennis & Co.

Test for Moisture in Transformer Oil.—While a thorough test for the suitability of oil for transformers and oil switches can be made only with high-tension testing apparatus, very good indications of the presence of moisture have been obtained by Mr. J. K. Mackie, superintendent of the Connecticut Power Co., as follows:—A sample of the oil to be tested is drawn from the bottom of the transformer, oil switch, or storage tank. (Samples from the upper parts of the tank are not considered suitable for the test, as water is heavier than oil and usually collects at the bottom.) In the sample thus taken is placed powdered anhydrous copper sulphate. If moisture is present the copper sulphate will be dissolved, producing a blue colour that will diffuse through the oil if moisture is in suspension. Since enough copper sulphate is added to ensure a saturated solution, the intensity of the blue tint will be a measure of the amount of moisture present. As small percentages of moisture have a very deleterious effect on the dielectric strength of oil, however, the lightest shade of blue is sufficient indication that the oil should be dried by filtering. It may be pointed out that other substances giving a deeper tint than copper sulphate may be used, the only requirement being that they dissolve quickly in water but not in oil.—*Electrical World.*

Australian Electrolytic Zinc.—According to the *Sydney Daily Telegraph*, further particulars were forthcoming in connection with the establishment of the Electrolytic Zinc Co., of Australia, Proprietary, Ltd. Speaking at the half-yearly meeting of the Amalgamated Zinc (De Bavay's), Ltd., in Melbourne, Mr. W. L. Baillieu, after indicating the lines of the new company, said that all the zinc concentrates were now disposed of through the Zinc Producers' Association Proprietary, Ltd., which body, through the good offices of Mr. Hughes, had effected the sale of 100,000 tons of concentrates for immediate delivery to the Imperial Government, and was now settling the details of a post-war contract for 1,000,000 tons at satisfactory prices. A substantial tonnage had also been sold to the Allies. The company would participate in these sales. The whole of its estimated output for 1916 had been disposed of, in addition to a fair percentage of the 1917 output. The company had been much assisted by the Prime Minister's arrangement that the production for ten years should be taken by the Imperial authorities at satisfactory prices.

THREE-PHASE EXTENSIONS AT WALLASEY.

As our readers may be aware, in the latter part of last year the Wallasey Corporation put to work a new three-phase generating station, designed on modern lines for cheap power production, and situated on a site where adequate fuel and water facilities existed.

The decision to build a new station was adopted in 1912 in preference to the alternative of making considerable extensions to the original one in Sea View Road, which, like so many of our original generating plants, was constructed at a time when the necessities of the future could not be adequately gauged.

The municipal supply of electricity—a single-phase one—was started in January, 1897, and has been financially successful from the commencement.

Direct-current extensions to the plant were made in 1900, in order to supply the tramway undertaking, and at a more recent date a 1,000-KW. three-phase turbo-generator was installed to cope with increasing demands.

The scheme for the new station, which was prepared by Mr. J. A. Crowther, the borough electrical engineer, involved the use of a site near the Birkenhead Docks with suitable railway facilities, and provided for two 1,500-KW. turbo-alternators, with condensers, boilers, &c., and the conversion of the existing station into a sub-station, and laying of E.H.T. cables to connect the two; rotary converters were to be provided for traction supply, and static transformers for lighting, while a margin would remain for three-phase power supply.

This scheme was approved by Mr. (now Sir John) Snell, and subsequently Mr. Crowther was instructed to carry it into effect.

In the meantime, however, the demand for energy greatly increased, and it was decided to install 3,000-KW. sets instead of the 1,500-KW. sets originally contemplated; the station was in running order last autumn, but for reasons connected with the war only one set has been available for use.

The initial equipment provided for is three Babcock boilers, each of 5,500 sq. ft. heating surface, and rated at 22,000 lb. evaporation per hour, with a maximum of 30,000 lb., to steam at 200 lb. per sq. in. pressure with 200° of superheat, also a similar but smaller boiler of 16,000 lb. per hour evaporative capacity.

The boilers are fitted with integral superheaters and chain-grate stokers, and three economisers are provided behind them, each of 3,000 sq. ft. heating surface, and each discharging into a Prat ejector type chimney equipped with a fan with variable speed motor drive. Two turbine-driven boiler feed pumps are installed, which exhaust into a feed-heater, raising the feed temperature to over 100° F., before it enters the economisers. The generating units will consist of two 3,000-KW. Westinghouse sets, delivering three-phase energy at 6,600 volts, and equipped with surface condensing plant and wet air filters; also a 1,000-KW. B.T.H. turbo-generator set. The circulating water is drawn from the adjoining dock, through screens, into a large tank near the engine room, and is discharged through 24-in. diameter cast-iron pipes leading back to the dock. All the pumps in connection with the condensing plant are of the rotary type, motor driven, and, indeed, there is no reciprocating plant in the station.

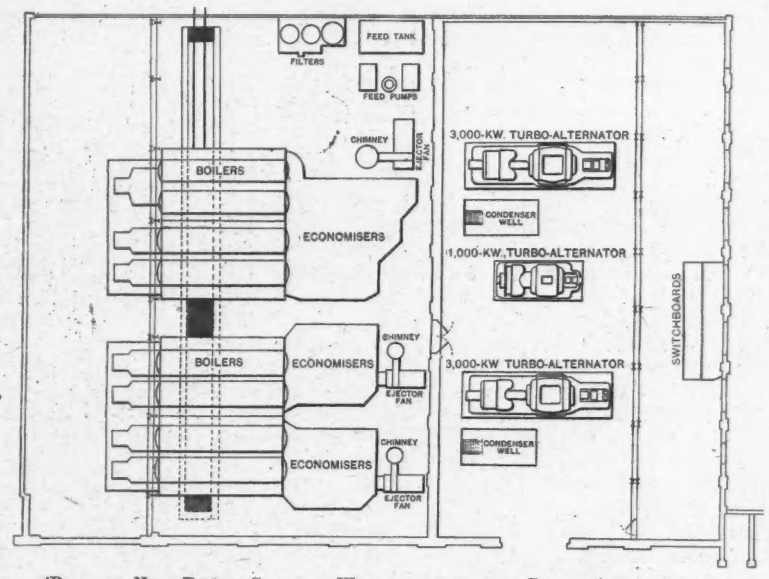
The E.H.T. switchgear was supplied by Messrs. Crompton, and includes three generator, four feeder, and two transformer panels, which supply the station auxiliaries and the small works adjacent to the station.

The E.H.T. feeders, as previously mentioned, connect to the old station, which is equipped with the necessary converting and transforming plant; they also run to large sub-stations on the Dock Road, for the supply of power to flour mills, &c., one of which is now a consumer of 4½ million units per annum, while others will be considerable consumers when the station is fully equipped.

It is satisfactory to know that the results obtained so far have quite justified the policy of the Council in building a new station, instead of extending the old one, where fuel cartage, and ash removal were considerable problems; the railway accommodation on the new site deals with all the traffic. A recent month's return shows that the new plant operates on 2½ lb. of slack per KW.-hour generated, showing a considerable economy on the old station, and similarly the amount of town water purchased is much reduced.

The buildings are of steel frame construction, filled in with brickwork, and lined with glazed brick inside; these buildings cost 32s. per KW. installed, while the cost of the turbo-generators and condensers amounted to £2 12s. per KW. installed, and that of the entire station, with the land (excluding cables), has been £6 17s. 9d. per KW. installed—an exceedingly low figure, even lower than that quoted recently in the case of the new Walsall plant, which is apparently of rather larger capacity (£7 12s. per KW., see ELECTRICAL REVIEW, November 24th).

The comparison is only a rough one, in the absence of details, but it is evident that the carrying out of the work reflects great credit on the borough electrical engineer, Mr. Crowther. To some extent the Wallasey design lends point to the arguments advanced in our remarks on power station design in our issue of November 24th, as the relatively low cost has been obtained with an arrangement of boiler plant—boilers, economisers, draught plant, &c.—on the floor level, whereas at Walsall a superposed arrangement was adopted leading to considerable space economy.



PLAN OF NEW POWER STATION, WALLASEY, SHOWING PLANT ARRANGEMENT.

We may mention that the Wallasey authorities possess a considerable area of land available for extending the plant, and that there is every indication of additional energy being required in the near future.

In conclusion, we are indebted to Mr. Crowther for his assistance in the preparation of these notes.

American Farm-Motor Installation.—The Lilac Hedge Farm, near Grand Forks, installed electrical equipment for the first time in 1911 for both lighting and power purposes. Electric drive has been used ever since for milking and other purposes (an average of 60 cows are milked twice a day). About 1,000 tons of ensilage are cut each year; all the threshing, feed grinding, wood sawing, water pumping, &c., is done by electric motors, two of which are stationary, one for driving the milking machine and one for pumping water. The rest of the farm work is done by a 35-H.P. portable motor, so arranged that it can be plugged in at various places on the farm. The installation has been a very satisfactory revenue producer for the central station, and has more than satisfied the owner of the farm.—*Electrical World.*

SOME ASPECTS OF INDUSTRIAL RESEARCH.

By E. W. MARCHANT.

The description given by Mr. A. P. M. Fleming in his lecture at Manchester, on Dec. 12th, of the development of industrial research in the United States, must cause everyone interested in the welfare of industry in this country to realise the urgency of the question if we are to maintain unimpaired and strengthened our industrial position.

A comment in the *Electrical World* for November 18th, 1916, on the scheme for industrial research proposed by Dr. Murray Butler, of Columbia University, may be of value as showing the point of view of the American electrical industry. It remarks that "we stand face to face with a Europe which will be organised with superb efficiency after the war." It seems doubtful whether the British part of the organisation is really as "superb" as the Americans appear to think it is, but there is no doubt that, as far as industrial research is concerned, American industry is far ahead of anything that has been attempted in this country.

Perhaps the most interesting development described by Mr. Fleming was that of industrial research laboratories in connection with large firms and manufacturing associations. It seems self-evident that institutes to carry on the kind of work done by these laboratories must be established in this country, either in connection with or independently of Universities.

It would appear that the best solution of the problem of industrial research will be the establishment of research laboratories, or institutes in which all problems in connection with any particular industry can be worked out. The difficulty of equipping any Institute capable of carrying out more than a small fraction of the research work required for the manifold industries of this country is insuperable, and still more difficult must be the task of finding a Fellow, or a number of Fellows or researchers, who have the necessary knowledge and experience to work out the practical problems that have to be solved. There are, besides such institutes, two other places in which research can be carried out—*i.e.*, the Universities and Higher Technical Schools and the research laboratories of the individual works. All these laboratories would seem to have a place in the scheme of industrial research which it is hoped may ultimately be established.

If one may attempt to define the scope of the various Institutions mentioned, the Universities and Higher Technical Schools will probably confine their work to the more general scientific problems which lie at the basis of the industry, the Research Institutes will deal with the development of scientific results into commercial processes, and the works themselves will deal with the technical research required to bring the operations involved in any process of manufacture to a high degree of efficiency. It is obvious that there are many cases in which the functions outlined above will overlap, but it is in the highest degree desirable that there should be some attempt to co-ordinate the different branches of industrial research.

It seems evident from the reply of Lord Crewe to the deputation on Scientific Research, last week, that the conditions laid down for the expenditure of money under the Privy Council scheme are such that comparatively little will be contributed by firms to help it forward. Whether a different view of the subject will be taken by the new Government remains to be seen; but unless the manufacturer is going to derive some direct benefit from the expenditure of his money, it seems very unlikely that he will be willing to spend it on research work. The most hopeful method would appear to be for the manufacturers to take the subject in hand for themselves, and establish institutions under their own control to assist their work. If this were done, Government grants might well be obtained to assist individual researches. The British Engineers' Association has already been formed, and there could be no better body to consider the establishment of research institutes for the engineering industry.

THE PARALLEL OPERATION OF ELECTRIC POWER STATIONS.

At a meeting of the Newcastle-upon-Tyne Local Section of the Institution of Electrical Engineers, on December 11th, Mr. J. S. Peck read his paper on this subject. Mr. H. W. Clothier presided, and stated that the Secretary had already sent their message of goodwill to the members who were serving at the Front.

Mr. Peck said that bringing to their notice the question of the parallel operation of power stations was something like "bringing coals to Newcastle," but when the paper was recently discussed it seemed to him that many doubted whether there was any such "coal" in Newcastle. He hoped the discussion would go to prove that such operation of stations was possible and reasonable.

The Chairman, in opening the discussion, said that when they read the discussion of the paper in London, it did seem that development in the matter of linking-up power stations was very much greater in the Newcastle district than elsewhere. They really got the impression in London that there was no such thing as linking-up, whereas when they looked round this district they found 16 power stations linked up in parallel. Of course, there were difficulties. Mr. Peck had said that one of the chief criticisms was directed to the power factor, and he supposed there were power companies or undertakings which would fight shy of linking-up, but he thought the difficulty was not so much one of an engineering character as a financial one. The question had to be settled who had to get the profit and who had to do the dirty work. As to the frequencies, he was rather surprised to hear Mr. Peck say that a low frequency of 25 cycles was easier for the switch to break than a higher frequency, because of the longer period near the zero line at the lower frequency. By linking-up more power was brought on to the switchgear, and the short-circuit current became heavier. He understood that in America the practice was to relieve the switchgear by putting into operation definite time-limit relays. Here we endeavoured to get our faults out as soon as possible after they were discovered, but were we right in doing that?

Mr. Vernier said that after reading the discussion of the paper in London he wondered how Tyneside had got on at all, for linking-up had been adopted so extensively.

Mr. Beard said he thought the best service they could do Mr. Peck and the industry generally was to emphasise the fact that the system of parallel operation had already been adopted. People outside that district did not seem to appreciate the extent to which the system had been developed. At present there were 15 or 16 power stations, and he thought the district could claim to be the most complete parallel-operating system in the country. In 1904 Carville and Forth Banks, fairly close together, were linked up; in 1905 Wallsend and a station eight miles away were linked up, and he heard of no special trouble that they met with. In 1910 the Tees and the Tyne were linked up, although 42 miles was the shortest route. On the one side they had 6,000 volts stepped up to 20,000 volts, then stepped down to 11,000, and then to 3,000. In several cases there was a change in frequency. In this connection, he mentioned the costliness of apparatus, and said that manufacturers in this country had not done enough on this subject, and often they had had to go abroad for it. The maintaining of regulators was a serious matter according to his experience, and all sorts of trouble arose as to insulation.

Mr. Jackson said he thought a good deal of the trouble with regard to the question they were considering lay in the matter of the governors. He advocated the use of the synchronous type of frequency changers.

Mr. Longman also emphasised the importance of the question of governors. Messrs. Turnbull, Carr, Gregory, and Porter also took part in the discussion, and Mr. Peck, in reply, expressed satisfaction at its character.

At a meeting of the Yorkshire Local Section of the Institution of Electrical Engineers, on December 8th, Mr. W. Lang occupying the chair, Mr. John S. Peck summarised his paper on "Parallel Operation," adding information as to tests which had been made on the previous Tuesday by Mr. Robertson, of Salford, on the paralleling of his plant with that of the Lancashire Electric Power Co. at Radcliffe. The Radcliffe pressure was 10,000 volts, and the Salford pressure 6,600 volts. They tried conveying 2,000 kw. from the Radcliffe station to Salford, holding the voltage at both ends of the line normal, and under these conditions they got the power factor on the interconnecting line up to .63. Both systems were controlled by automatic voltage regulators, so that the voltage was maintained absolutely constant. The voltage at Radcliffe was raised from 10,300 to 10,500, 2 per cent., and the voltage at Salford remained the same. The power factor then came up from .63 to .87. Then the voltage at Salford was dropped from 6,600 to 6,500, keeping the voltage 2 per cent. higher at Radcliffe, and that gave a power factor of .95. That meant that when they were sending power from Radcliffe to Salford with a voltage exactly equal —exactly normal—with 2,000 kw. flowing into Salford, they

got a power factor of .63. As the voltage at Radcliffe was raised and the other was lowered, the power factor came up gradually to .95, until, when there was a difference approximately of 3½ per cent., they got the best conditions. Radcliffe did not care to raise the voltage any higher, and Salford did not care to go any lower. That connection was with about five miles of overhead line, 10,000 volts, and approximately one mile of underground cable. The next thing they did was to put another feeder in parallel, the second feeder being entirely underground, and by rather a roundabout way. Starting with normal voltage again, 6,600 at Salford and 10,300 at Radcliffe, they got 2,000 KW. with .74 power factor instead of .63. Keeping the Salford voltage at 6,600, and raising that at Radcliffe just 2 per cent., the power factor came up to unity. Next they raised the load from 2,000 to 3,000 KW., still in the same direction, Radcliffe to Salford. Under normal conditions that would give a worse power factor. The voltages were maintained as before. First they had Radcliffe 2 per cent. higher and Salford normal, and the power factor dropped from unity to .83. Holding Radcliffe still 2 per cent. up, they dropped Salford about 1 per cent. down to 6,570, and the power factor came back to unity again. Thus it became quite apparent that by a very small change in voltage at the two ends of the line it was possible to shift the wattless current from one station to the other and get unity power factor in the line. Readings were taken on quite a large number of instruments, and all the readings seemed to check up quite well. The next test was reversing the flow of energy, taking power to Radcliffe from Salford, and in this they got very much the same conditions; when they raised the voltage at Salford and dropped the voltage at Radcliffe, and maintained a difference of about 3 to 3½ per cent. they got 2,000 KW. transmitted at unity power factor, and this showed that the load could be transmitted in either direction without trouble.

In the course of the discussion, Mr. R. H. CAMPION said Mr. Peck had almost started again the old battle of the systems. He had noticed in connection with synchronous sets that the stations which had synchronous sets and motor-generators always had the best regulated power factor. The stations he had in mind were supplying cotton manufactories, and they got much better power factors than were got in Yorkshire. He had been interested to see that Mr. Peck now practically recommended the rotary converter for changing to the D.C. supply, and he had noticed that rotary converters worked very much better with 25 periods than with 50. There did not seem to be half the experimental work required with 25 periods that there was with 50.

Mr. CHRISTIANSON said the paper seemed to raise the whole question of standardisation of frequency, voltages, and phases. In his view, paralleling would not be a success until the question of voltage regulation was dealt with. Under the majority of the present voltages in this country the opportunity for parallel running seemed very limited, and it appeared that before anything could be done on any large scale we should have to adopt very much higher voltages, probably of the order of 50,000. There were considerable difficulties in linking-up with the present voltages which would be reduced with the higher voltages.

Mr. T. ROLES said the chief engineer whose office was a mile away from the works had little opportunity of observing the paralleling; the sport and fireworks were left to his assistants. He remembered the old days when it used to be a question not only of paralleling the alternators, but also paralleling the engines. He had never heard of any trouble in paralleling in connection with the Bradford works. As to the matter of periodicity, he did not think there was likely to be much trouble in Yorkshire. He did not know of a single undertaking in that district which had not 50 periods, and that would get over a large amount of trouble in the early days of interlinking. The question of what was to be the periodicity of the super-station which was now talked about was a matter that should be very thoroughly looked into before any super-station was put down for any special district. As to the voltage of transmission, he did not think much could be done with the present voltage of 6,000. If there was going to be any linking-up with the larger stations to effect any useful purpose, such as a saving of plant, a question of serious consideration would be what was the highest voltage which could be used with cables which could be procured. So far as he could find out from the makers, 33,000 was about the highest voltage they would guarantee. They would make cables for 40,000 volts, but if they did they would want the consumer to share the risks with them.

Mr. W. M. SELVEY said he had occasion lately to go into the question of transmission, and he realised the importance when one was linking-up two stations of ascertaining, to begin with, for what purpose they were being linked up. The object of linking-up nowadays was an attempt to increase the economic factor by supplying a smaller station at such times as that smaller station itself could not generate, and the cable between them should, therefore, be called a transmitter. If it was a long cable, they had to consider that transmitter as if the small station was a consumer. They had to consider the amount of power they had to send down, and unless they made use of the transmitter in the same sense that they would if they were supplying a customer there was very little economic justification for it. If they were going in for linking-up, it was not a question of linking-up two stations, but one of linking-up a number of stations, and as soon as they got to linking-up more than two there were quite a number of new problems. The fact seemed to be that the only solution of the question of linking-up power stations was that one main station should do the bulk of the work and take the responsibility, and the smaller stations should run at 100 per cent. load factor and take practically no responsibility at all. On the whole, linking-up was the right thing, and there was no doubt the problems would be solved.

Mr. WILSON HARTNELL said there must be some standard voltage. He thought also that Mr. Peck should presently look into the question of cost.

Mr. NORMAN STELL said one of the great factors to be taken into account was the life of the cable.

Mr. J. E. STORR said he thought that until they could get forward with the higher pressure cable work there would not be much headway. He thought the cable manufacturers would have to consider more not what they would make or guarantee, but what the consumer was going to call for. With high voltages and some method of correcting power factor they would be better able to deal with the interconnecting problem.

The CHAIRMAN said that the point might be overlooked that the cost of interconnecting and the troubles which were always incidental to it might make it not worth bothering with. The money might, perhaps, be far better used if it was admitted that, in certain small stations, much better results might be obtained if they were simply used as distributing centres rather than to aim at the 100 per cent. load factor which Mr. Selvey referred to.

Mr. PECK, replying to the discussion, said that had been one of the most peaceful meetings he had had, for, contrary to some of his previous experiences, they all seemed to think that this paralleling business was easy. There seemed to be two classes on the question, one headed by the Editor of the *Electrical Times*, who seemed to believe that there was some wonderful mystery which made it impossible to operate in parallel, and the other class perhaps best represented by Mr. Fedden,* who had a communication in the ELECTRICAL REVIEW in which he said he did not see what all this talk was about, because he had been operating in this way for years past. As to the higher voltage for linking-up, he thought it was purely a question of balancing the cost of the extra copper against the increased cost of high-voltage cable and the transformer which would be required. Where the power stations were located long distances apart it would be necessary to go to higher voltages, but in other cases he did not see why the connecting cable of 6,000 volts should not afford a great amount of relief where stations were overloaded. He had purposely avoided dealing with the question of costs because that had been done in the report issued by the committee of which Mr. Robertson, of Salford, was secretary, and Mr. Woodhouse was a member. This committee had worked out the case for linking-up in Lancashire, and made out a very excellent case. He scarcely considered himself capable of dealing with the question of the best kind of cable. The central-station engineers had much more experience of that than he had.

THE EXPORT TRADE TO THE FAR EAST.

THIS was the title of a paper read to the members of the BIRMINGHAM AND DISTRICT ELECTRIC CLUB recently by Mr. W. G. L. RIDDLE (President). He said that everyone connected with the Far Eastern business knew that previous to the war their greatest competitors were the Germans, although, even at that time, they were, in turn, feeling the competition of the Japanese in the low-priced articles of household commodities and apparel. In his opinion, there was no doubt that Japan would become a great power in trade with China because of her close proximity, which meant low freights and transit charges. Then, again, Japan could send her travellers to penetrate China, where the standard of living was somewhat of the same nature as that of Japan. Before he left China in April last year, Japan was making large quantities of electrical porcelain goods, flexibles, and the smaller sizes of cables. In other words, Japan lay at China's door, and the needs and peculiarities of the Chinese were better known to Japan than to any other nation. Some years before the present war broke out the General Electric Co., of Schenectady, built a factory in Japan to manufacture electric lamps and fittings, and some five years ago, when the Shanghai Municipal Council issued their specification for a year's supply of metal-filament lamps, the contract was secured by the Japanese works at a price that no British firm could touch. When he was in Shanghai, one could go into any electric sundries store and purchase a lamp for 1s. that one would have to pay 2s. 8d. for in Birmingham, and from what he was told by one of the Council's engineers the lamps made in Japan were superior to many of the British makes. This competition was very hard to fight against. They might also expect increased competition from America in engineering enterprises in China.

* See also the ELECTRICAL REVIEW of October 13th, November 10th, &c., for the Editors' opinions.—EDS.

The Germans put a lot of money into the mining business, under Chinese names, because under the Chinese Mining Regulations only 50 per cent. of the capital was to be foreign, and the profits in the same proportion. The Germans, however, ignored this preposterous stipulation, and got the Chinese to pose as the capitalists, having an understanding with the Chinese that they, the Germans, were to do the exporting of the mine output, and that they should import the machinery for the mine. This opened the way for the importation of all classes of cargo, the Germans being established by this means in many important centres in China. The Germans had also sunk much money in China in antimony mines, and were beginning to get it back tenfold. The Germans employed experts in every line of business, and were not content to do business as commission agents in Shanghai, Tientsin, and Hankow. They sent their men right into the interior of China, and got hold of the actual producer of raw material and introduced to him imported goods of German manufacture. How could English houses hope to get the business out in China, or in their Colonies for that matter, when the English banks and commercial houses here at home were full of German clerks, humble looking, underpaid individuals, but who were in the pay of the big German banks and firms, say in Hamburg, and who knew what business was being done by their English employers? These clerks, as they went home to lunch or supper, dropped a code telegram to their employers in Hamburg or Berlin, with the result that the quotations given by the competing English and German firms in China were different by a point or so—the German firms getting the business. It was the same in the import trade from China to England; English banks and English firms full of Germans. One of the largest German firms in Shanghai, with a registered head office in London, and swagger offices in Hong-Kong and Shanghai, posed before Britishers in China as "all the same" English firm trading under our flag, traded on our social advantages, and undercut us with German goods at every turn. Was not it marvellous that we never saw how we were being bled to death? Why did the staffs in the German firms in Shanghai always have to work later than the English and French firms? Because they had to put in an hour or two extra in drawing up secret reports to send to their principals, giving particulars of what they had heard from their English and French friends at the clubs. The Germans considered anything was worth looking into, and passed business on to one another. Not so the English firms.

British manufacturers should get their goods on the Chinese market as cheaply as possible, making what the Chinaman wanted, not too good, but something that would last a reasonable time. As it was quite an expensive business for an English firm to send a representative to China, he would suggest that, say, five or six British firms who made somewhat similar machinery should combine and send a smart Britisher out to China as their representative to work under a British firm of merchants in China, who would act as the combine's agents, having offices in some principal centre, such as Shanghai, Teintsin, or Hankow. The representative should not be a pure salesman, but a man who had been through the shops and knew his business thoroughly. Manufacturers in this country, failing to form a combine, and being unable to send out their own representative, should co-operate with firms already established in China who knew the country and the trade routes. Travellers for home manufacturers were not so effective as a locally established representative. The Chinese liked to deal with a Britisher who had an established Chinese Hong name, and they looked with suspicion upon a strange foreigner.

He was often asked the question: Will the Germens get the business after the war? Personally, he did not see that there was anything to prevent them, especially if they could undersell us and give the Chinese long credits again. They probably had not been able to do much business during the war, but they were "carrying over," so to speak, with the Chinese. They had kept their staffs going at reduced pay. The Chinese would be only too glad to take advantage of the foreign commercial situation. The Germans had been keeping their trade going by using American firms, and but for the shortage of tonnage on the Pacific and the congestion of freights on the American railways, this would have been very serious for us. Unlimited capital expenditure was the only way to capture profits anywhere in the world, and, after the war, we should have to face competitors using money they had made out of us during the war, using German methods of business. If English capitalists would put money into development work in China, and with our financial whip-hand at Pekin this was more possible for us than any other nation, something would be done to keep their trade going, because the development work would give them good face with the Chinese and combat the idea that we were short of money. He had always found the Chinaman a good man to do business with. His word was practically as good as his bond, although that trait of his would die out, and was probably not so good as it was 20 years ago. A Chinaman delighted in a bargain, and it was no use, whether one was buying or selling with him, one must be prepared for a bargain. The Chinaman knew three classes of cargo; he preferred the English if he could afford it. Say it was priced at 75 cents at an English Hong, 60 cents at a German, and 40 cents at a Japanese. The Chinaman would buy the German article, because, at any rate, it was foreign goods, and though it might not last as long as the British goods, it was what he wanted; and, besides, the extra 15 cents might be just beyond his means, though he would not descend to the trashy Japanese article. To the uneducated Chinese the German could always pose as an Englishman, the foreign names conveying nothing to the Chinaman. The German used their language in business in Shanghai, as in other places in China. To his mind it was extremely probable that German competition would be keener after the war was over, and as it would require more export business than ever to bring more money into the country, it was up to Britishers to fight Germany on their own ground, using better methods than they did. They must meet German competition and secure for British Labour and Capital a fair share of what must in time be an important and expanding business, especially as China developed her mining and industrial resources.

British houses who were at present established in China and could handle engineering and machinery on an extensive scale could almost be counted on the fingers of one hand, but they were principally firms of good financial standing with branches in many parts. China was a huge country, and in many of the provinces the British had not touched it at all. So Germany had had no competition to fight except among themselves, and consequently had been able to secure full margins of profit. Germany after the war would have to devote her attention in a greater degree to such neutral countries as China, where there was no sentiment against her, and they could only hope that she would be so crippled financially that her banks and finance houses would not be able to accord the long credits and the exceptional facilities to her merchants that were formerly in vogue.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Recruiting Skilled Engineers.

I was much interested in your remarks in the leading columns of the REVIEW of Friday last, *re* Diesel engine stations, which, unfortunately, I have had no time to glance through until to-day. I am not sure whether by chance one of the stations you refer to is Newcastle-under-Lyme, but, if not, perhaps the enclosed information may be of interest:—

Plant.—6 engines (2 Diesel and 4 gas).

Staff.—Chief engineer, aged 33, married, passed for C3 service; senior assistant, aged 33, married, passed for B2 service; second assistant, boy of 17 years of age; junior assistant, none; jointer and main assistant, none; power station fitter, none; engine driver, age 40, married, passed for C1 service; engine driver, over age; general labourer, none.

With the above staff we are attempting to keep things going. My senior assistant having, fortunately, served his time as a fitter, is running shift and also doing the fitter's work, and in his spare *(sic)* time assisting me with the outside work.

At the last meeting of the local tribunal it was suggested by the Military Representative that the engine driver could easily and quickly be replaced by a woman, and that a woman could also, with a little training, take the place of my one and only qualified assistant.

Comment is, I think, unnecessary. I may say that I only succeeded in getting two months' exemption for each of these men, which means, of course, that we must, as you state, inevitably shut down if further exemption is at any time refused to either of the men in question.

A. J. C. De Renzi,
Borough Electrical Engineer.

Newcastle-under-Lyme,
December 13th, 1916.

Breakdowns of German Plant.

With reference to your comment on "Breakdowns of German Plant" in your issue of the 1st inst., whilst agreeing with the same I think the end desired will never be attained until our own manufacturers wake up to the fact that they owe something more to their customers than merely delivering the goods. Complaints of faulty workmanship or working should receive prompt attention, and any alterations found necessary should be carried out in a speedy manner and not at the expense of the customer; especially should that be done where manufacturers have turned their attention to new types of plant of which they have had no practical experience. Your mention of Mr. Edgcome's experience is unfortunate; I have here two foreign (not German) engines, which certainly required some alterations made at first; these were promptly carried out at no expense to ourselves. On the other hand, the first English-built engine of this type, which we installed in October, 1913 (one of the first they made), has given no end of trouble, the general reply to our complaints being lack of attention or suggestions of inexperience; finally, the engine has been dismantled since May last, and although we (to save expensive law

costs) agreed to pay half the cost of the repairs, we are still without the use of this engine.

Wake up our own manufacturers to their responsibilities; when that is accomplished they need not fear German competition.

H. L. Alderton.

Electricity Works, Guildford,
December 13th, 1916.

Everyone appreciates your endeavours to forward the interests of the British engineering trade by bringing "together a number of instances" of faults in German design. One feels an immense amount of enjoyment at the instances quoted, but the joy is tempered by the reflection that the full uses of a specification are not yet appreciated, or we should not see the buying of plant which is admittedly against correct modern practice and experience. It is not to be wondered at that "engineers who have been bitten are not proud of their scars, and are apt to conceal them jealously," if their scars are analogous to some of the reported instances.

In the account of the breakdown of a 5,000-KW. A.E.G. turbo-alternator it is stated "the blading was found to be of an alloy containing an excessive proportion of nickel—over 31 per cent.—a material well known to be unfit for use, especially with superheated steam." I submit that by keen carrying-out of a properly drawn specification such an error would not occur.

In the address on "The Power Supply of the Rand," by Mr. Bernard Price, and with reference to the complicated winding on a large alternator, one assumes in such a case that designs would be submitted with tenders, and "studied" by the intending purchasers; or is it merely a case of buying a "pig in a poke," and then complaining of the badness of the "German pig"?

In the instance of steam pipes, one wonders what—yes—what ordinary mill mechanic would have installed such pipes; it is apparent that the art of combining practice with theory in a common-sense way is still not understood.

In the case of the four A.E.G. transformers which were found to be so "badly designed that the purchasers decided to have them reconstructed and re-wound before even putting them in service," surely, by the adoption of a proper procedure and scrutiny, such a drastic series of operations could have been avoided.

Finally, I submit that British engineers, in accepting the above examples of German engineering, do not add to our national engineering reputation, and, after reading your account, one is left with the impression that expensive plant is still bought by some people, like anyone would buy a pound of tea or sugar.

John Stansfeld.

Leeds.

[With regard to the Melbourne turbine and the transformers which had to be rewound before use, it should be noted that these were all delivered just before the outbreak of war, and consequently it was not possible to call the German makers to account for any departure from specifications.

The excuse offered by the A.E.G. for the excessively complicated winding of their rotors and the impossibility of rewinding them outside the makers' workshops, was "that the workmanship and design were such that breakdowns, and consequently the necessity for rewinding, *were impossible*"!

So far as the record of disaster on the Rand is referred to in the last paragraph of the above letter, we believe the British engineers had no choice in the matter; the Germans held the debentures of the company, and stipulated that the plant should be purchased in Germany. For this scandalous condition the reluctance of British capitalists to finance the undertaking was responsible.—EDS. ELEC. REV.]

A War Bonus for the Managerial Staff.

£1 WORTH 12s. 6d.

LIVING 60 PER CENT. DEARER THAN BEFORE THE WAR.

Board of Trade figures issued last night show that retail prices of food on December 1st were about 3 per cent. higher than a month earlier.

It is estimated that the average increase in the cost of living of the working classes between July, 1914, and the present time, taking food, rent, clothing, fuel, and light into consideration, is about 60 per cent. Disregarding increased taxation, that means that the sovereign is worth 12s. 6d.

—From the *Daily Mail*, December 16th, 1916.

Is there no room for improvement in dealing with the man who does not perform the manual labour of the works but is the brains or the business-getter of the organisation?

—Extract from page 647, THE ELECTRICAL REVIEW, December 15th, 1916.

Most of the electrical engineering firms are now controlled establishments.

Provision has been made in the Ministry of Munitions Acts for an increase of at least 20 per cent. above the average profit for the standard period. This provides for an increase in dividends for the shareholders, whereby they meet the increase in the cost of living.

Provision has also been made in the Munitions Acts whereby the Minister can authorise a war bonus for the managerial staff. All that is necessary is that an application be sent by the controlled establishment management to the Minister of Munitions for the permission to pay such a war bonus.

Some applications have been made and granted, so the principle has been approved.

No doubt it is just an oversight that other applications have not been made; but it is just such oversights as give point to the observation quoted above from THE ELECTRICAL REVIEW.

Those occupying positions of responsibility feel that on matters of this kind the initiative should come from the management, and that there should be a recognition of the fact that the increase in the cost of living has equally affected the brain worker as well as the manual worker.

No doubt the publicity obtained by the insertion of this letter in your widely-read paper will cause some boards of directors to wonder why the point did not occur to them before, and they will hasten to rectify the omission.

A Brain Worker.

The Use of Low-Grade Fuels.

There seems to be an impression that, because it is technically possible to employ high-ash fuels in a water-jacketed gas producer fitted with an eccentric revolving grate to discharge the ash continuously, such an indirect firing method should be adopted for steam boilers.

In the case of the colliery cited in the Report of the U.S. Bureau of Mines, there is nothing to show whether the gas is used in internal-combustion engines or not; but the fact is very clear, that while it was technically possible to handle the low-grade fuel for which the revolving-grate producers were installed, the reduction of unit capacity was prohibitive.

The low-grade fuel was selected batts, 52·12 per cent. ash, 18·37 per cent. volatile matter, 6·99 per cent. moisture, only 5,065 B.TH.U. per lb.; but the fuel actually used was crushed and then washed, producing a fuel with only 24·60 per cent. ash, 28·75 per cent. volatile matter, 5·86 per cent. moisture, 9,869 B.TH.U. per lb.

This actual fuel could obviously be burnt direct to great advantage on mechanical stokers, having not only continuous ash-discharge, but also continuous coal-feed, thus eliminating the manual labour of charging to producers.

Prof. Fearnsides' proposal to utilise the second-class coal of the upper Barnsley seam provides for its being screened and washed, so that it will contain as many heat units per ton as the best coal now brought into Sheffield.

As every refuse-destructor plant evidences, there is no technical difficulty in raising steam from the direct combustion of low-grade fuel; but, on commercial grounds, the duty per unit of space is so small, and the labour cost so high, that even at collieries it pays much better to screen and wash out excess dirt, rather than to handle a large proportion of incombustible matter with the fuel.

A favourite size unit water-tube boiler raises 50,000 lb. superheated steam, involving the efficient direct combustion of three tons of good slack coal hourly; this is easy duty for a 12-retort continuous-cleaning grateless underfeed stoker, 20 ft. wide, which can be applied to a boiler of 23 ft. outside width, with depth for stoker plus boiler from 17 ft. upwards.

For an equal duty with indirect firing of the same boiler by producer-gas plant of 75 per cent. efficiency, the fuel and ash would be one-third more, and the space and cost would be prohibitive.

The revolving-grate gas-producers with washers, shown in the Report of the U.S. Bureau of Mines, are 2 metres, say, 6 ft. 8 in. in internal diameter, and occupy a space of 7 metres, viz., 23 ft. wide. Assuming that each producer can gasify one ton of coal hourly, this means that four such producer units would be required for the 23-ft. water-tube boiler, raising 50,000 lb. of steam hourly.

Instead of mechanically handling 3 tons of coal hourly by a single 12-retort stoker for direct combustion, and discharging the ash continuously, the indirect firing method would involve the manual charging of 4 tons of coal hourly to four separate gas-producers, with mechanical discharge of ash alone.

The thermal efficiency of direct-firing with modern mechanical stokers leaves no scope for improvement; and stokers assembled from any number of retort-units permit unlimited unit-capacity of boilers.

While the 12-retort stoker for 3 tons of coal, or 50,000 lb. of steam, is a good example of modern central-station practice, one plant alone has five double-ended boilers, each with two 15-retort continuous-cleaning stokers, two and a-half times that capacity.

It is perfectly possible to burn high-ash coal on such stokers; but, whether for stokers or for gas-producers, dirty coal means reduced unit capacity, and therefore it pays far better to screen and wash out excess dirt at the colliery, and to employ good quality fuel.

Erith's Engineering Co., Ltd.

London, E.C., *December 18th*, 1916.

Heat Standard for New York Gas.—The Public Service Commission for the Second District of New York has made an order fixing heat units instead of candle-power as the standard of value for artificial gas. Hereafter gas must average 585 B.TH.U. per cb. ft., instead of 16, 18, or 20 C.P., as heretofore. With the universal substitution of electricity for lighting, the Commission finds that gas is more and more being developed as an agency for cooking, heating, power, and other industrial and domestic purposes where heat value is of supreme importance and illuminating power of no consequence whatever.—*Electrical World.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

UNITED KINGDOM AND CERTAIN FOREIGN COUNTRIES.—A Supplement (Part I) to the *Board of Trade Journal* of November 23rd contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from Denmark, France (including Algeria), Greece, Italy, Japan, and the Netherlands. This Supplement also contains the complete list of articles which are prohibited to be exported from the United Kingdom. A further Supplement (Part II), issued on November 30th, contains similar lists for Norway, Portugal, Roumania, Russia, Spain, Sweden, and Switzerland, and this Part contains also a copy of the United Kingdom Contraband List complete to date. The information given in these two Supplements supersedes that given in the Supplement published on August 17th last. Copies of the Supplements may be obtained, price 3d. each (post free 3½d.), from Messrs. Wyman & Sons, Fetter Lane, E.C.

PROTECTORATE OF SOUTH-WEST AFRICA.—By a Proclamation dated July 25th, the Union of South Africa Act No. 37 of 1916 is made applicable to the South-West Africa Protectorate, the effect being to put the Customs and Excise Tariffs of the Union and the Protectorate on a uniform basis. [The alterations effected in the Union Tariff by the Act above referred to, so far as they affect electrical goods, were indicated in the ELECTRICAL REVIEW of September 15th.]

TANGA (EAST AFRICA).—From an official notice published in the Zanzibar *Gazette* it appears that an import duty of 10 per cent. *ad valorem* has been fixed for all goods entering the Port of Tanga.

"GERMAN" EAST AFRICA.—According to a telegram received at the Colonial Office from the Government of the East Africa Protectorate, a specified portion of the territory known as German East Africa was opened to traders on December 1st, subject to local regulations.

FRANCE.—A Presidential Decree, dated October 25th, provides that, from December 1st, import and export declarations relating to goods dutiable by weight, by number, or by measure, or to goods which are free of duty, must specify, for statistical purposes, and in addition to the particulars required for the application of the Customs Tariff, the *value* of the goods at the place and time of presentation to the French Customs Authorities.

RUSSIA.—It is announced in the official *Torgovo Promyshlennaya Gazeta* of Petrograd that the importation of all goods on private account into the Russian Empire, *viâ* Vladivostock, except those connected with Government requirements, is at present prohibited. While this prohibition is of a temporary character, it is impossible to say how long it will continue, as the period must depend upon the amount of Government material to be railed and on the capacity of railway conveyances. Applications for permission, in each separate case, to import goods for the requirements of the Government are to be addressed to the Department of Trade at the Ministry of Commerce, Petrograd.

BRAZIL.—Telegraphic information has been received at the Foreign Office from H.M. Minister at Rio de Janeiro, to the effect that the Brazilian Budget Bill for 1917, which has already been passed by the Chamber of Deputies, but has still to be approved by the Senate, proposes that the proportion of all import duties which must be paid in gold shall be raised from 40 per cent. (the rate fixed by the Budget Law for 1916) to 55 per cent. This proposal would in effect increase the amount of duty leviable on goods imported into Brazil by 12½ per cent., at the present rate of exchange. Should this provision be incorporated in the Budget Bill as passed by the Senate, the new rate will come into force on January 1st, 1917, and will apply to all goods not actually presented for clearance in the Custom houses on or before December 31st, 1916, irrespective of the date of arrival of such goods in Brazil.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Published expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

17,361. "Cooling by means of convection of air or pressure of air the central electrode of sparking plug for igniting gas in internal-combustion engines." F. MURTAGH. December 4th.

17,373. "Jointing electric furnace electrodes." V. STOBIE. December 4th.

17,388. "Galvanometers." E. E. FOURNIER D'ALBE. December 4th.

17,393. "Electrically-operated signal indicators for mine haulage, winding, &c." J. P. FORSTER. December 4th.

17,415. "Commutator brushes for electric motors, dynamos, &c." J. H. MALLOW. December 5th.

17,433. "Electrically-heated gas jet." H. A. EWEN. December 5th.

17,450. "Systems of electrical distribution." H. A. GILL (U.S. Light and Heat Corporation). December 5th.

17,451. "Dynamo-electric machines." H. A. GILL (U.S. Light & Heat Corporation). December 5th.

17,452. "Variable-speed generators and storage-battery systems." H. A. GILL (U.S. Light & Heat Corporation). December 5th.

17,453. "Systems of electrical distribution." H. A. GILL (U.S. Light and Heat Corporation). December 5th.

17,454. "Dynamo-electric machines." H. A. GILL (U.S. Light & Heat Corporation). December 5th.

17,476. "Method for multiplying frequency of electric currents." MARCONI'S WIRELESS TELEGRAPH CO. & I. SHORNBERG. December 5th.

17,507. "Electrical discharge devices." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). December 6th.

17,513. "Steering gear for vehicles." E. C. R. MARKS (Mercury Manufacturing Co.). December 6th.

17,526. "Electric annunciator systems for calling attendance." E. E. ROGERS. December 6th.

17,527. "Electrical projecting apparatus." F. O. READ & L. GIDDINGS. December 6th.

17,528. "Dynamo-electric machinery." E. S. G. REES & W. ARMISTEAD. December 6th.

17,539. "Machine for conversion or simultaneous production of alternating currents of different frequency." BERGMANN ELEKTRICITATS WERKE AKT. GES. December 6th. (Germany, December 8th, 1915.)

17,536. "Current generators for telephonic, &c., calls." J. B. NABERES. December 6th.

17,539. "Electric capacity." G. GILES. December 6th. (Switzerland, December 9th, 1915.)

17,553. "Electrical switches." R. W. BILL. December 7th.

17,572. "Electrical fire alarm." H. VERNON. December 7th.

17,588. "Electrical discharge tubes." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). December 7th.

17,590. "Electric filament-lamp." A. C. W. ALDIS & F. A. WANKLYN. December 7th.

17,681. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). December 8th.

17,593. "Apparatus for operating door bolts, &c., by electrical means." E. C. R. MARKS (Suddeutsche Telefon-Apparate Kabel-und Drahtwerke Akt. Ges.). December 7th.

17,603. Detection of earth connections in electric cables." G. GILES. December 7th. (Switzerland, December 9th, 1915.)

17,626. "Dynamo-electric generators, and reversing mechanism therefor." J. STONE & CO. AND A. H. DARKER. December 7th.

17,666. "Method of preventing sparking in electrical machines." J. G. P. THOMAS & THOMAS TRANSMISSION, LTD. December 8th.

17,669. "Alloy." ELECTRO METALS PRODUCTS Co. December 8th. (U.S.A., September 29th.)

17,681. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). December 8th.

17,702. "Electric ovens, hot cupboards, &c." J. S. LANGFORD. December 8th. (New Zealand, January 14th.)

17,709. "Electrical instrument for indicating instantaneous pressures or currents." J. T. IRWIN. December 9th.

17,716. "Electric fuses." W. E. BRADSHAW AND CALLENDER'S CABLE & CONSTRUCTION Co. December 9th.

17,739. "Lighting fixtures." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). December 9th.

17,749. "Wireless telegraph transmitters." W. S. ENTWISTLE & MARCONI WIRELESS TELEGRAPH Co. December 9th.

17,752. "Electric fire or radiator." H. H. BERRY. December 9th.

PUBLISHED SPECIFICATIONS.

1915.

12,150. CONNECTOR FOR THE ADJACENT PORTIONS OF TWO OR MORE ELECTRICAL WIRES, CABLES, OR THE LIKE. A. H. Fargo. August 23rd.

12,151. CONNECTOR OR COUPLING FOR THE ADJACENT END PORTIONS OF TWO OR MORE WIRES, CABLES, OR OTHER MEMBERS. A. H. Fargo. August 23rd.

13,504. ELECTRICAL DISTRIBUTION SYSTEMS. E. T. Williams. September 22nd.

14,769. WIRELESS SIGNALLING SYSTEMS. British Thomson-Houston Co. (General Eectric Co., U.S.A.). October 19th.

16,336. ELECTRO-DEPOSITION AND EXTRACTION OF ZINC. J. C. Tainton and J. N. Pring. November 19th.

16,443. METHOD OF AND APPARATUS FOR PRODUCING AND DISTRIBUTING ELECTRIC CURRENT WAVES. British Thomson-Houston Co. (General Electric Co., U.S.A.). November 22nd.

16,464. DYNAMO-ELECTRIC MACHINERY. E. C. Eborall (Akt. Ges. Brown, Boveri et Cie.). November 22nd.

16,476. ALTERNATING-CURRENT MOTORS. A. H. Neuland. November 22nd.

16,846. ELECTRIC SWITCHES. E. T. Brook & G. H. Bishop. November 30th.

16,994. ELECTRIC HEAT RADIATORS. A. F. Berry. December 2nd.

18,114. METHOD OF ELECTRIC WELDING. D. H. Wilson. December 29th. (July 9th, 1915.)

1916.

The numbers in brackets are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

572. ELECTRIC STREET PILLAR BOXES AND SIMILAR ELECTRICAL ERECTIONS. B. Welbourn and British Insulated & Helsby Cables, Ltd. January 13th. [102,163.]

679. MOUNTINGS FOR ELECTRIC SWITCHES AND CONNECTING APPARATUS. H. E. Mitchell. January 15th. [102,167.]

1,278. ELECTROLYTIC BATTERY. MacKay Copper Process Co. April 9th, 1915. [100,264.]

2,114. ELECTRIC SWITCHES. R. H. Williams. February 12th, 1916. [102,184.]

2,478. ELECTRIC CONDUCTOR GRIPS FOR RELIEVING THE CONNECTION OF SUCH CONDUCTORS WITH ELECTRIC FITTINGS FROM PULLING STRAIN. S. Fildes. February 19th, 1916. [102,188.]

2,896. ELECTRICAL SOUNDERS, HOOTERS, OR THE LIKE FOR TELEPHONE OR OTHER PURPOSES. E. A. Laidlaw. February 26th, 1916. [101,763.]

6,005. DRY CELLS AND BATTERIES THEREOF. C. F. Burgess Laboratories. May 28th, 1915. [100,586.]

6,329. TELEGRAPHIC TRANSMISSION DEVICES. R. d'Antonio. May 3rd, 1916. [102,214.]

6,483. X-RAY APPARATUS. C. E. Campbell. August 7th, 1915. [101,143.]

8,359. ELECTRIC ARC LAMPS. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.). June 13th, 1916. [102,231.]

8,470. DEVICE FOR ATTACHMENT TO THE SPARKING PLUGS OF PETROL AND THE LIKE ENGINES FOR AUTOMATICALLY CLEANING AND COOLING THE SPARKING POINTS OF SUCH PLUGS. A. E. Lamkin. June 15th, 1916. [102,222.]